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ORIGINAL ARTICLES

Sphenopalatine Block in the Relief of Musculoskeletal Pain. Maurice S. Rawlings, Capt., M.C., U. S. A., and Charles S. Wise, M.D. 5

Diagnosis of Injury to the Roots and Branches of the Lumbar Plexus With Report of a Case. Raoul C. Psaki, Lt. Col., M.C., and John H. Kuitert, Lt. Col., M.C. 10

A Mechanical Quadriceps. Louis N. Rudin, M.D., and Daniel J. Cronin 15

Introduction to Problems of Education Therapy. Fritz Friedland, M.D., and Rueben J. Margolin, Ed. D. 20

Diathermy Generators. E. L. Hall, E.E. 28

●

Editorial 37

●

Medical News 41

●

Standing Committees, American Congress of Physical Medicine ....

Book Reviews ....

Physical Medicine Abstracts ....

●

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EARL C. ELKINS, M.D.
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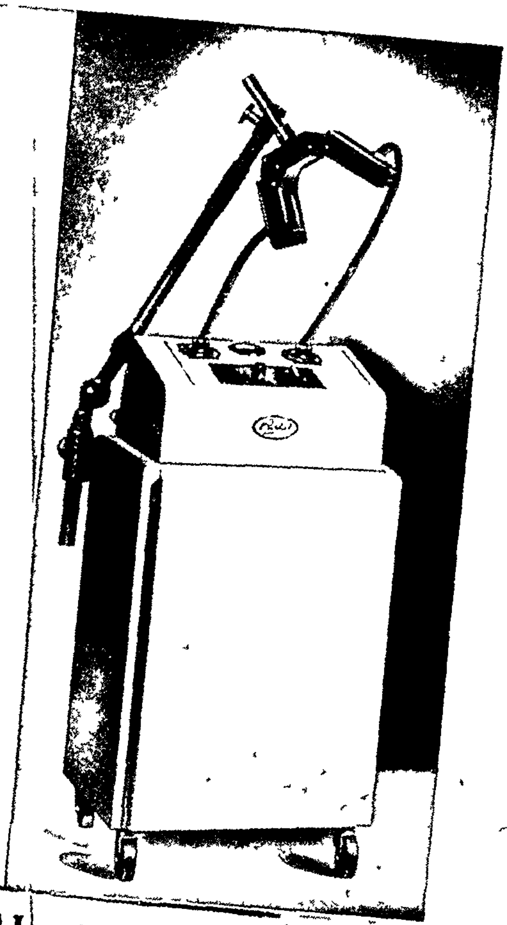

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SPHENOPALATINE BLOCK IN THE RELIEF OF MUSCULOSKELETAL PAIN

MAURICE S. RAWLINGS, CAPT., M.C., U.S.A.[**]
and
CHARLES S. WISE, M.D.[*]

Ruskin[1] and Amster[2] have claimed dramatic relief of musculo-skeletal pain in a wide variety of clinical conditions following the use of topical sphenopalatine anesthesia. Their method consisted of application of a surface anesthetic to the posterior nasopharynx in patients exhibiting muscle spasm and pain associated with rheumatoid arthritis, low back pain, subdeltoid bursitis and other clinical entities. Following single or repeated applications, marked subjective and objective relief was reported in almost all *their patients. Despite the lack of a controlled study by these authors, the* simplicity of the technique employed and the excellent results claimed warranted a more critical review of the procedure.

This paper presents a controlled study of the effectiveness of sphenopalatine block in a group of patients suffering with a variety of musculoskeletal and related disorders. The study included 178 individual treatments. Sixty-nine of these treatments were considered placebo in nature.

Method

All of the patients in this series were selected from a hospital out-patient department; most of the patients were selected from an arthritis clinic. The procedure employed closely followed that described by Amster[2] and consisted of the intranasal introduction of two per cent tetracaine (Pontocaine ®) hy*drochloride on cotton applicators to the vicinity of the sphenopalatine ganglia* bilaterally where they were allowed to remain for a period of twenty minutes. A control group received a similar application of normal saline which had been tinted with methylene blue to simulate the color of tetracaine hydrochloride solution. Other controls received either two per cent tetracaine hydrochloride or normal saline applied beneath the tongue. The saline had been tinted with methylene blue and flavored with lemon extract to imitate tetracaine hydrochloride solution in appearance and taste.

Before each treatment the patients were given the same instructions. They were told that the treatment was an experimental procedure being studied for its possible pain-relieving effects; that it might or might not have any effect on their particular pain. No other verbal suggestions were given as to its probable effects. Subjective complaints and objective findings *were evaluated both before and after treatment. Limitation in joint motion,* tenderness of the affected areas, and an estimation of the degree of pain were carefully recorded in each case. Certain individuals received specific measurements of performance, such as maximum strength measurements of various muscle groups. These evaluations were made before treatment, at the termination of treatment twenty minutes later, and again when the patient returned on a subsequent visit one or more days later. The patient was instructed to record the duration of any effects noted. The results were graded several days after each treatment and in those instances where patients received more than one treatment, a final evaluation and grading was made at the end of the completed course. The results were graded as excellent, good, fair, or unchanged. Those graded as "excellent" were patients who had complete relief of symptoms persisting for days or weeks following treatment as well as similar objective evidence of improvement. The patients graded as "good" showed considerable but incomplete relief of subjective symptoms, with some improvement in objective findings which continued for several day or weeks. Those patients considered as "fair" had partial relief of subjective symptoms but only slight, if any, improvement in objective findings. The unchanged group had no effects noted subjectively or objectively. There were no patients who attributed exacerbation of symptoms to this procedure.

[**] Resident in Medicine, The George Washington University Hospital, 1949 1950.

[*] Director, Department of Physical Medicine and Rehabilitation, George Washington University, Washington, D. C.

[1] Ruskin, S. L. A Newer Concept of Arthritis and the Treatment of Arthritic Pain and Deformity by *Sympathetic Block at the Sphenopalatine (Nasal) Ganglion and the Use of the Iron Salt of the Adenylic* Nucleotide, Am. J. Digest. Dis. 16:386, 1949.

[2] Amster, J. L.: Sphenopalatine Ganglion Block for the Relief of Painful Vascular and Muscular Spasm with Special Reference to Lumbosacral pain, New York State J. Med 48:2475, 1948

Results

Because of the wide variety of clinical disorders and the response obtained, the number of treatments per patient varied. The majority of patients received one to three applications, although several received more. The clinical diagnosis in the seventy-two patients treated is shown in the following table:

Diagnosis	Number of Cases
Rheumatoid arthritis	21
Hypertrophic arthritis	10
Low back pain	12
Fibrositis	9
Subdeltoid bursitis	6
Rheumatoid spondylitis	4
Tension headache	4
Neuralgia	4
Miscellaneous	2
Total	72

Clinical diagnosis of patients treated.

Of the seventy-two patients treated, forty-four received two per cent tetracaine hydrochloride as sphenopalatine blocks. A control group of twenty-eight patients received topical application of saline to the sphenopalatine area or sublingual application of either saline or tetracaine hydrochloride as described above. Some of these control patients subsequently received tetracaine hydrochloride applications to observe comparative effects. Twelve patients in the control group received no tetracaine hydrochloride to the sphenopalatine area at any time. As previously described, the response to each treatment was recorded, and a final evaluation of each patient's response was determined on the basis of degree and duration of improvement at the completion of all treatments. These final patient evaluations are shown in the following table:

	Pontocaine (44 Cases)		Control (28 Cases)	
Excellent	23% (10)	62% improved	25% (7)	75% improved
Good	25% (11)		36% (10)	
Fair	14% (6)		14% (4)	
Unchanged	38% (17)		25% (7)	

Final evaluation of individual cases.

For comparison, an analysis of the response obtained for each of the 178 treatments is shown in the following table. These results are based on the evaluation of each individual treatment; the evaluation being made one or more days following the individual application.

	Tetracaine Hydrochloride		Control (69 Treatments)	
Excellent	27% (29)	81% improved	33% (23)	81% improved
Good	40% (44)		26% (18)	
Fair	14% (15)		22% (15)	
Unchanged	19% (21)		19% (13)	

Evaluation of effects of each of 178 treatments.

Discussion

The fact that a great number of pharmacological agents may be employed in the symptomatic relief of musculoskeletal pain is in itself an implication of their non-specific nature. Likewise, the results of the studies tabulated clearly indicate that the effects of anesthetization of the sphenopalatine ganglia as described by Ruskin[1] and others cannot be explained on the basis of any specific neurogenic reflex in the autonomic nervous system. In our early clinical trials employing tetracaine hydrochloride sphenopalatine block in active rheumatoid arthritic patients, the marked and even dramatic improvement obtained in some patients led us to attempt a more controlled study. Normal saline was then applied to the posterior pharyngeal area in several patients as a control. This resulted in responses similar to those obtained with tetracaine hydrochloride. In order to obviate the possibility of mechanical irritation of the sphenopalatine area by the cotton applicator, which might serve as a possible mechanism either neurogenically or reflexly through the adrenal cortex, applicators of tetracaine hydrochloride were placed sublingually. As a further control to rule out systemic effects of absorption of tetracaine hydrochloride through the mucous membrane, another group of patients were studied using sublingual saline, also with comparable results.

A remarkable finding in the entire group studied was the high percentage of patients showing objective and subjective relief to a procedure having no demonstrable pharmacological or physiological basis. Many patients with obvious, active, severe rheumatoid arthritis showed marked symptomatic relief of pain within several minutes after treatment. A few patients with acute lumbosacral strain also showed complete relief of symptoms and increased or complete range of motion of the lumbar spine. One patient complaining of low back pain for twelve years had complete and continuing relief of symptoms for at least three months (when last seen) following the application of sphenopalatine block. Equally dramatic results were observed in the control group.

Comparing the results of the tetracaine hydrochloride and control groups, there was essentially no difference. In fact, a small group of patients receiving only sublingual placebos showed the highest percentage of satisfactory results (87 per cent improved in 31 sublingual applications). It appears from these studies that suggestion is the modus operandi for the relief of musculoskeletal pain obtained by sphenopalatine block.

The effectiveness of suggestion in influencing any therapeutic procedure or drug has been beautifully demonstrated in the pain threshold experiments of Wolff and Wolf.[3] Beside the specific pharmacologic effects of a given therapeutic agent, equally profound effects may occur by way of suggestion inherent in the use of the substance or by way of any transferable optimism on the part of the attending physician. The existence of an extensive list of physical as well as pharmacologic agents valuable in the treatment of various musuloskeletal disorders may be in part due to psychogenic factors that are inherent in any form of medical treatment. Seidel and Abrams[4] found that hypodermic administration of saline was just as effective as vaccines in treating the chronic rheumatoid state. It is to be noted that in our control group, 75 per cent of the patients treated were subjectively or objectively improved, including 25 per cent who were graded as having "excellent" results. Many in this latter category could be described as exhibiting "dramatic" improvement. These results suggest that any medication or therapeutic procedure claimed to be specifically effective in the treatment of musculoskeletal pain should evoke improvement in more than 75 per cent of cases treated, and excellent results in 25 per cent of cases. Conversely, it can also be stated that one should not look for obscure neurogenic reflexes or pharmacologic actions of the various medications and procedures employed in the relief of musculoskeletal pain unless the possibilities and the varied profound effects of suggestion have been carefully controlled. A good review of the use of placebos in therapy may be found in the Cornell Conferences on Therapy.[4]

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[3] Wolff, H. G., and Wolf, S.: Pain. Am. Lects. in Physiol. Cp. 93, Thomas Co., Springfield, Ohio, 1948.

In patients with acute or subacute low back pain or other musculoskeletal disorders, the presence of protective muscle spasm may persist long after the initial cause of low back pain has subsided. This prolonged immobilization may lead to structural changes or pain, while prolonged muscular contraction through distortion of muscle, ischemia, fatigue and traction on other structures may lead to further painful stimuli, tending to maintain the muscle spasm. Relaxation of this spasm is frequently followed by the disappearance of pain and the return of mobility. This has been variously accomplished through local or spinal anesthesia, spasmolytic drugs, psychotherapy, and physiotherapy. The method of "mechanical psychotherapy," such as topical sphenopalatine block, seems to be quite effective in alleviating, at least temporarily, the psychogenic component of many organic symptoms, and could be useful in determination of such a differentiation. Susselman[5] suggests that the differentiation may also be made by the intravenous injection of 0.1 Gm. of amobarbital sodium (Sodium Amytal^{R}). The dose apparently is sufficient for relaxation, but insufficient for analgesic effect. Some have felt that the differential response between local procaine and saline injections could be used diagnostically.[6]

The incidence of functional states in arthritic and musculoskeletal disorders have not been as widely appreciated as they have in the fields of neurology, cardiology and gastroenterology. In military medicine, psychogenic complaints localized in the muscles and joints were comparable to those in the cardiovascular and gastrointestinal system.[7-8-9] This is made evident by the large number of patients admitted to the arthritic and orthopedic wards with organic diagnoses in which inadequate or no structural changes existed.[7] Functional musculoskeletal disorders treated by placebo or nonspecific therapy over prolonged periods may lead to fixation of symptoms and should be avoided.

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[4] Seidel, and Abrams: The Use of Placebos in Therapy, Cornell Conferences on Therapy, Vol. 2, p. 5, MacMillan, New York, 1947.

[5] Susselman, S., et al.: Intravenous Injection of Amobarbital Sodium (Sodium Amytal R) as a Test for Latent Anxiety, Arch. Neurol. & Psychiat. 56:567, 1946.

[6] Steinbrocker, O.: Therapeutic Injections in Painful Musculoskeletal Disorders with Special Reference to the Saline-Procaine Test. J. A. M. A. 125:397, 1944.

[7] Boland, E. W., and Corr, W. P.: Psychogenic Rheumatism, J. A. M. A. 123:805, 1943.

[8] Short, C. L.: Arthritis in the Mediterranean Theater of Operations. 1. Incidence of Joint Disease — Clinical Description of Rheumatoid Arthritis. 2. Clinical Description of Hypertrophic Arthritis, Arthralgia and Psychogenic Rheumatism, New England J. Med. 236:383, 1947.

[9] Somatization Reactions. Bull. U. S. Army M. Dept. 5:640, 1946.

In view of the large incidence of functional overlay in musculoskeletal disorders, sphenopalatine block would be expected to be effective in a large per cent of any group of patients so treated, and might serve as a useful adjunct to physiotherapy in determining those cases with overlying psychological disorders that may require treatment by psychological means.

Summary

1. A controlled study of the efficacy of surface anesthetization of the sphenopalatine ganglion area for the relief of musculoskeletal pain has been presented.

2. A group of 72 patients received a total of 178 test applications. Forty-four patients received 2 per cent (Pontocaine[R]) tetracaine hydrochloride to the sphenopalatine area. Twenty-eight received sublingual applications or intranasal saline as control procedures.

3. There was no significant difference in response between control and test groups. Seventy-five per cent of control patients were benefited compared to sixty-two per cent for the test group.

4. Topical sphenopalatine block is considered a non-specific procedure having no demonstrable pharmacological or physiological basis. It would appear that suggestion is the modus operandi.

5. The large incidence of musculoskeletal neurosis and psychogenic rheumatism, either pure or superimposed on organic lesions, is comparable to the high incidence of improvement from sphenopalatine block obtained in this series. Sphenopalatine block, therefore, should be considered a psychotherapeutic agent only; although it may also serve to temporarily relieve the functional aspects of disability in some cases of organic disease.

6. No physical or pharmacological therapy effective in musculoskeletal disease should be considered specific until the varied and profound effects of suggestion have been carefully controlled.

* * *

DIAGNOSIS OF INJURY TO THE ROOTS AND BRANCHES OF THE LUMBAR PLEXUS WITH REPORT OF A CASE[*]

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Diagnosis of Traumatic Injury to the Roots and Branches of L-2, 3 and 4: Report of a Case

Interest in nerve injuries is always stimulated during the hostilities of modern warfare. Injury to several branches of the lumbar plexus secondary to a shell fragment wound presents a remarkable study in anatomy (fig. 1).

The lumbar plexus is located in the substance of the psoas muscle.[1] It is usually formed by the anterior primary divisions of the first three lumbar nerves, part of the fourth and occasionally part of the twelfth thoracic nerve. The first, second and fourth lumbar nerves each divide into upper and lower branches. The upper branch of the first lumber nerve forms the iliohypogastric and the ilioinguinal nerves. The lower branch of the first lumbar nerve unites with the upper branch of the second lumbar nerve to form the genitofemoral nerve. The lower branch of the second lumbar, all of the third and the upper branch of the fourth lumbar divide into anterior and posterior divisions, which ultimately form the primary motor nerves of the lumbar plexus. The three anterior divisions join to form the obturator nerve and the posterior divisions unite to form the femoral nerve and the lateral femoral cutaneous nerve. From the roots small twigs supply the psoas and quadratus lumborum.

The femoral nerve is motor to the iliopsoas, sartorius, pectineus and quadriceps muscles. It is sensory via the anterior femoral cutaneous nerve to the anterior and medial surfaces of the thigh and via the saphenous nerve to the medial side of the leg and foot.

The obturator nerve is motor to the obturator externus, adductors and gracilis. It is sensory to the medial aspect of the lower thigh.

Report of a Case

A 22 year old colored Army sergeant was wounded by a mortar shell fragment on August 11, 1950 in Korea. He was struck in the back just to the left of the spine of L-3 and was evacuated to a field hospital. A shell fragment was removed from the abdomen and a wound of the jejunum was repaired. During his convalescence atrophy of the left thigh was noted which was obscured by a complicating thrombophlebitis which responded to therapy. The patient was transferred to the U. S. and arrived at an Army hospital on December 28, 1950.

Physical examination revealed a well healed right rectus surgical incision. On the back just to the left of the midline at the level of L-3, there was a small scar, which was the wound of entrance. The extremities revealed atrophy of the left thigh. X-ray revealed a foreign body at the level of the second and third lumbar interspace (fig. 2).

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[**] Chief Resident, Physical Medicine, Walter Reed Army Hospital.

[***] Chief, Physical Medicine Service, Walter Reed Army Hospital.

[1] McDonald, J. J.; Chusid, J. G., and Lange, J.: Correlative Neuroanatomy, ed. 5, Los Altos, Calif., University Medical Publishers.

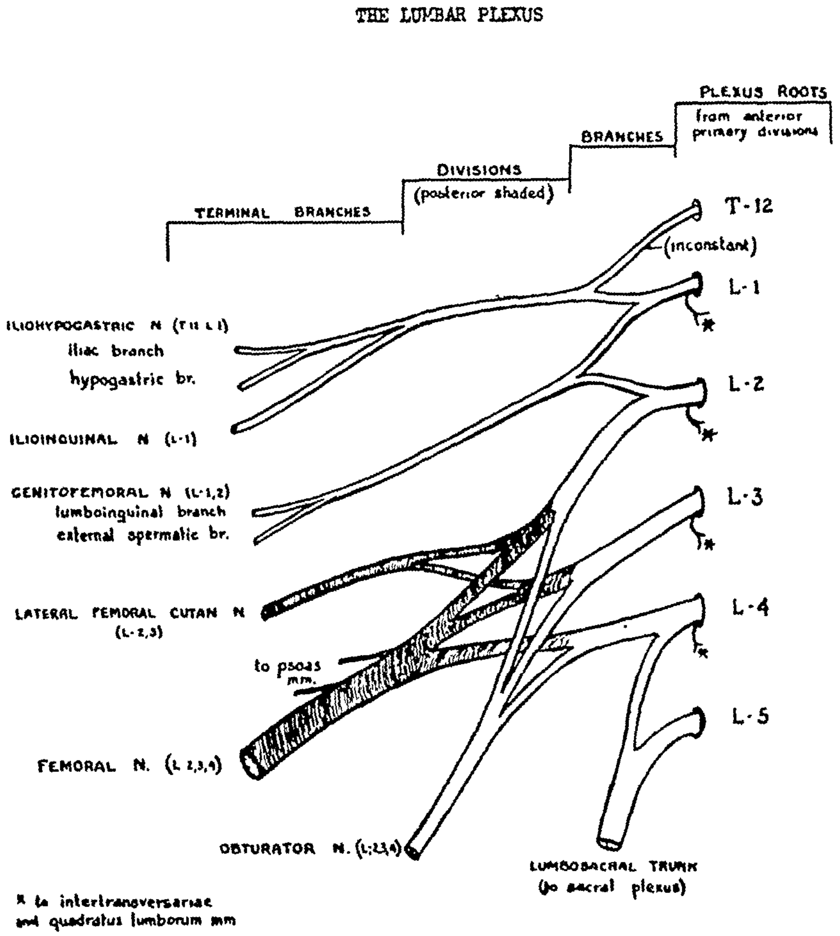

Fig. 1. — The Lumbar Plexus:
From McDonald, Chusid and Lange, Correlative Neuroanatomy,
University Medical Publishers.

Sensory examination[2] revealed hypesthesia over the antero-lateral and medial aspect of the left thigh, antero-medial aspect of the left knee and antero-medial aspect of the left leg and median aspect of the foot. Reflexes were all normal except the left knee jerk, which was absent. A voluntary muscle test[3] revealed the following strengths expressed in percentages of 100. Left quadratus lumborum — 100, left iliopsoas — 5, quadriceps 0-10 per cent, sartorius — 0, adductors (magnus) — 10, gracilis — 0, biceps femoris, semitendinosus and semimembranosus — 60, gluteus maximus — 80, gluteus medius and tensor fascia latae — 80. All other muscles in left lower extremity were 100 per cent.

Cobalt Chloride Sweating Test

When there is interruption of a nerve, the area supplied by the nerve loses its sympathetic nerve supply and thus, its ability to perspire. The cobalt chloride in the non-sweating area, represented by the shaded pattern, remained blue and unchanged (fig. 3).

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[2] Haymaker, and Woodhall: Peripheral Nerve Injuries, W. B. Saunders Co., Phila., 1945.
[3] Kendall, and Kendall: Muscle Testing and Function, Williams & Wilkins, Baltimore, 1949.

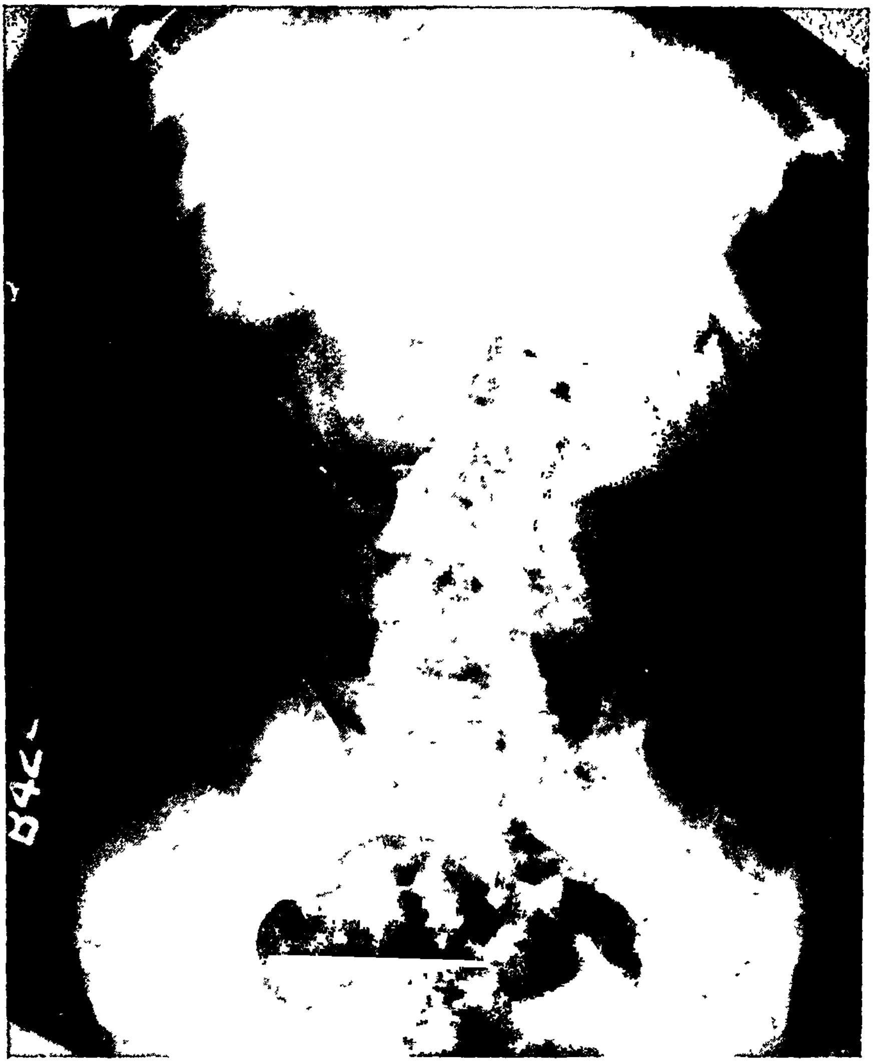

Fig. 2. — Roentgenogram, Anteroposterior of Lumbar Spine, Showing Foreign Body.

Neuro-Dermometry Skin Resistance

This test[4] depends upon the sympathetic component of the peripheral nerve. Thus, elimination of the sympathetic supply produces an increase in the skin resistance. The pattern of increased skin resistance was similar to the sweating pattern noted in the cobalt chloride test.

Electrical Diagnosis

Faradic Test. — There was no response elicited over the left quadriceps muscle to the faradic current.

Galvanic Test. — The response of the muscle to the galvanic stimulation was sluggish and slow.

Electrodiagnostic examination (EDX) revealed that the strength-duration curve was elevated with a steep slope. The repetitive stimuli revealed a wide spread with the lower frequencies. The tetanus contraction was incomplete with the maximum tolerable current.

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[4] Richter, C. P., and Woodruff, B. G.: Lumbar Sympathetic Dermatomes in Man Determined by the Electrical Skin Resistance Method, J. Neurophysics 8:323, 1945.

Electromyography

An electromyogram was done on January 8, 1951, using the intramuscular needle electrode technique.[5] The following muscles were examined: The left quadriceps, sartorius, and adductors which all revealed fibrillation

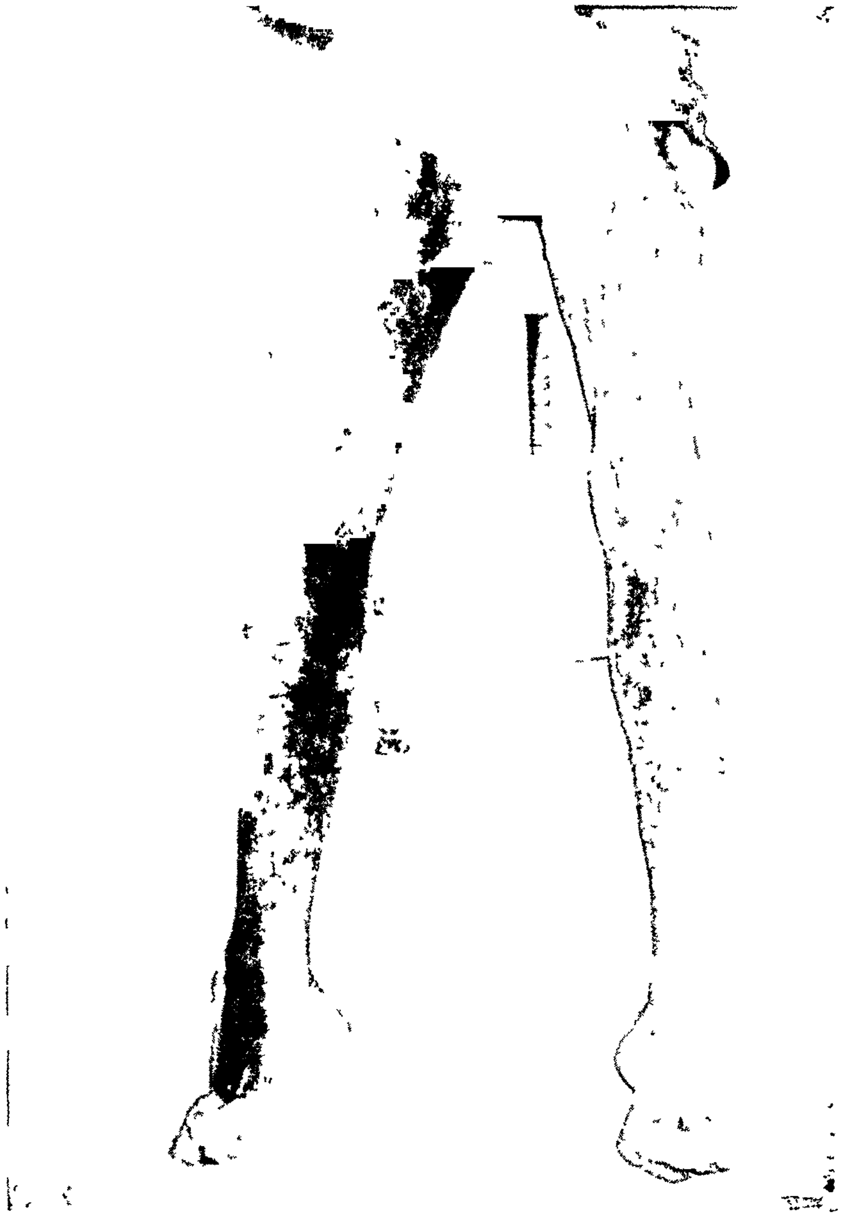

Fig 3 — Cobalt Chloride Sweating Test
Shaded Pattern Represents Non Sweating Area

and complex motor units. Low voltage normal units of 150 watts was recorded. The hamstrings, tensor fascia, lata, gluteus medius and maximus revealed normal motor units. Some complex motor units were found to a lesser extent the tensor fascia and gluteus medius. The findings are consistent with injury to the roots and branches of L-2-3-4 on the left in the paravertebral region.

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[5] O. Leonard Huddleston, M. D, James G Golseth, M D; Alberto A Marinacci, M.D, and Elizabeth Austin, M.D. Archives of Phys Med 31:378 (June) 1950

Conclusion

This case is presented because it not only demonstrates the methods available for adequate study of a peripheral nerve injury but also for localization of that lesion anatomically.

The sensory examination, cobalt chloride and skin resistance tests, place the lesion in the distribution of the femoral and obturator nerves which are derived from the second, third and fourth lumbar nerves. (See fig. 1.)

The voluntary muscle test further localizes the lesion, because strong voluntary function of the quadratus lumborum is indicative of an intact proximal root and the weakness is distal to this point.

The fibrillation found to be present in the muscles supplied by the roots of L-2 and 3 is absolute evidence that denervation is present. The additional findings of complex motor units in the tensor fascia lata and gluteus medius to a lesser degree, with predominantly normal motor units, signifies a partial involvement of the fourth lumbar root. This also explains the trace function and low voltage readings in the quadriceps and trace function in the iliopsoas, which both receive part of their innervation from the fourth lumbar nerve.

This lesion should specifically involve the lower branch of the second lumbar root, the distal root and branch of the third lumbar root and part of the upper branch of the fourth lumbar root.

Summary

1. A review of the lumbar plexus is presented.
2. A case of traumatic injury to the roots and branches of the lumbar plexus is reported.
3. The methods of diagnosis available to localize a peripheral nerve injury are presented.
4. The value of electromyographic studies in the diagnosis of peripheral nerve root injury (not easily accessible by other methods) is presented.

* * *

A MECHANICAL QUADRICEPS [*]

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BALTIMORE, MARYLAND

Impairment of quadriceps function, varying from mere weakness to complete paralysis, presents an important problem in rehabilitation work. The quadriceps is a key muscle in the maintenance of the upright posture and in locomotion. It prevents the knee from collapsing when acted upon by the weight of the body. It extends the leg from a position of flexion and makes forward stepping possible. The quadriceps is assisted in performing these functions by the tensor fascia lata and the gluteus maximus. Injury to the quadriceps is common in fractures of the femur. Adhesions which form between the muscular layers prevent efficient muscle contraction. Paralysis of the quadriceps due to direct injury to the femoral nerve is relatively rare. This is because the nerve runs very close to the femoral artery and vein, and any trauma to the nerve also involves the femoral vessels; this results in exsanguination and death, or amputation, because of inability to establish a proper collateral circulation after the ligation of these vessels. On the other hand, disease affecting the nerve cells and the axons of the femoral nerve is frequent in any lower motor neuron involvement, such as poliomyelitis and peripheral neuritis. The quadriceps atrophies very readily in many patients who are confined to bed. The atrophy is more than just a disuse atrophy and is based on some reflex phenomenon which is not yet understood.

The prevention and treatment of quadriceps atrophy and weakness, or partial paralysis, consists mainly in active and resistive exercises. In many cases, in spite of a prolonged course of exercise, there is enough residual weakness to prevent the patient from standing or walking. To overcome quadriceps paralysis and deficiency, the standard procedure is to apply a long leg brace with a knee lock, which keeps the knee rigid for the support of the body. When the patient sits down he releases the knee lock and is able to flex the extended extremity at the knee. It is obvious that a long leg brace with a knee lock is a rigid formidable apparatus to wear in walking, and there is the added inconvenience of having to release the knee lock on sitting down, especially when the patient uses crutches. Where an upper extremity is involved in addition, as in hemiplegia or some cases of poliomyelitis, the unlocking of the knee, in addition to crutch handling is very inconvenient for the patient.

As a substitute for an irreversible, permanent weakness, or paralysis of the quadriceps, a brace attachment has been developed by Mr. D. J. Cronin. This consists of a spiral spring of piano wire, made of tempered steel, which is attached with screws to a standard long leg brace (fig. 1). The tension developed by the spring ABC depends upon the gauge of wire, the number and circumference of turns, and whether a spring is used on one side or both sides of the brace. The tension of the spring ABC, acting through its levers AB and BC, produces a tension in the direction shown by the arrows. This keeps the knee extended in standing and in walking. On sitting down the leg is flexed by the action of the hamstrings, which overcome the tension of the spring. This eliminates the necessity of a knee lock on the brace (fig. 2). In walking the spring allows for some to and fro flexibility of the knee joint (fig. 3), which is an additional improvement over the absolute rigidity of the usual long leg brace with a knee lock. The degree of quadriceps deficiency and strength of the hamstrings will determine the amount of tension desired in the spring. This in turn will be accomplished by the proper choice of wire, number of coils, and whether a unilateral or bilateral attachment is fixed to the brace.

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[*] From the Physical Medicine Rehabilitation Service and Orthopedic Brace Shop, Veterans Administration Hospital, Fort Howard (Baltimore), Maryland.

[*] This is the first of a series of steel spring substitutes for permanent, irreversible muscle deficiencies, which are being worked out through the cooperative efforts of the Physical Medicine Rehabilition Service and the Orthopedic Brace Shop.

[†] Chief, Physical Medicine Rehabilitation Service.

[‡] Supervisor, Orthopedic Brace Shop.

[*] Published with permission of the Chief Medical Director, Department of Medicine and Surgery, Veterans Administration, who assumes no responsibility for the opinions expressed or conclusions drawn by the authors.

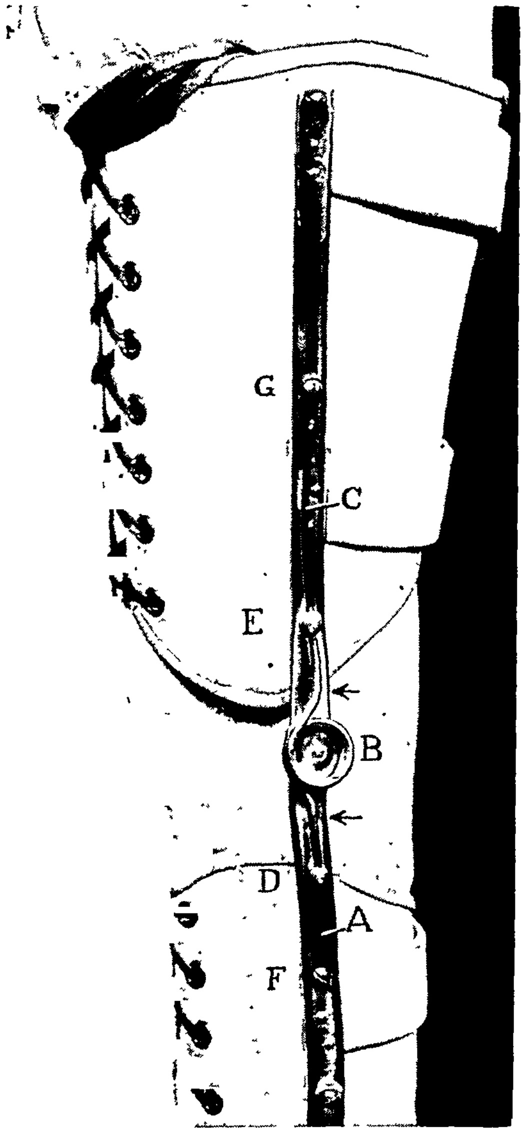

Fig. 1. — Spiral spring ABC attachment to long leg brace by posts D and E and screws F and G. Direction of tension is shown by arrows.

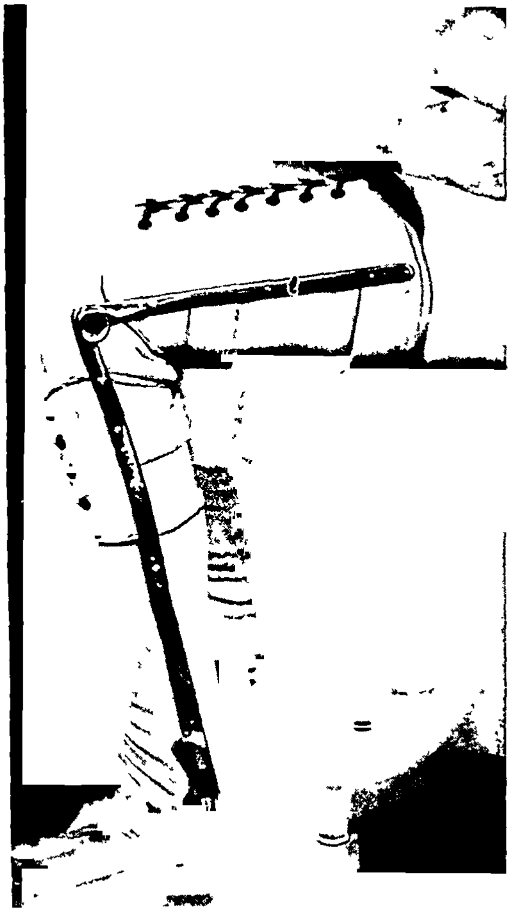

Fig. 2 — In sitting down, the tension of the spiral spring is overcome by the hamstring muscles Note, there is a foot drop element incorporated in this brace, to overcome a coexisting foot drop

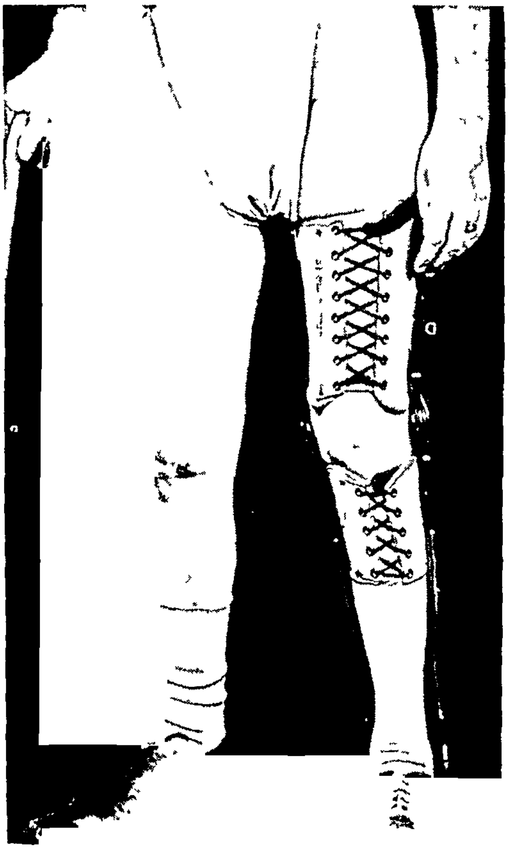

Fig. 3. —In walking there is some to and fro flexibility at the knee joint.

Predetermination of Tension in the Spring

It is desired to have the greatest tension in the spring. The stronger the spring action, the greater will be the stability at the knee joint. The limiting feature is the strength of the hamstrings, because they have to overcome the tension of the spring on sitting down. In order to estimate approximately the strength of the spring desired for a particular case, the following technique has been worked out:

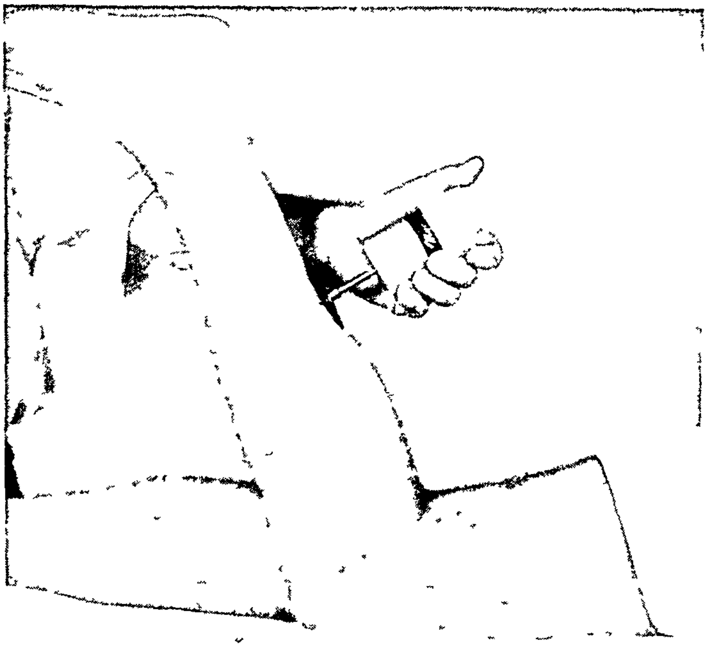

Fig 4 — The power of the hamstring muscles is being determined with the Newman Myometer

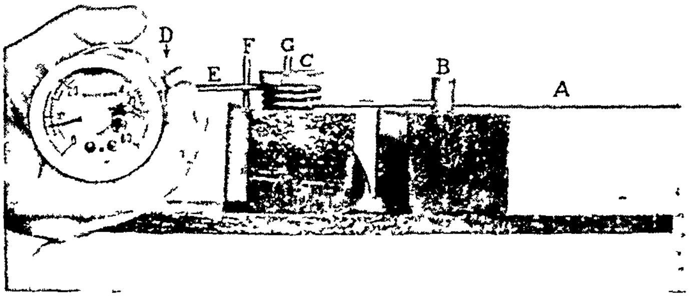

Fig 5 — Block and fittings for mounting and measuring tension of coiled springs Arm of spring A is secured in post B The coiled part of the spring is secured by a threaded screw with a large knurled head C The sliding attachment D is tightened against arm E of the spring with a set screw. It furnishes a base plate for pressure by the Myometer When the arm of the spring E is at post F it is at an angle of 45 degrees, and when at G, it is at an angle of 90 degrees

1. The patient is lying face down on a treatment table. His knee is flexed at about 90 degrees. With a Newman Myometer[1] or spring scale the leg is extended against maximum resistance offered by the patient (fig. 4). This furnishes an approximate estimate in pounds, as to the strength of the hamstrings.

2. A spring is mounted on a special block with a securing mechanism. Pressure is produced against the free arm of the spring until it is at right angles to the other arm, and read off in pounds (fig. 5). The correct tension of the spring in pounds, should be about half of the strength of the hamstrings, also measured in pounds.

Stating this differently, for practical considerations, the hamstring muscles have to be at least twice as strong as the spring, so that when they voluntarily contract, as in sitting down, they can easily overcome the tension of the spring and bring the knee from extension into flexion.

In standing or walking, the weight of the body (with or without the aid of the hamstrings), is able to cause various degrees of flexion in the knee, but the inherent tension of the spring, acting always in the same forward direction, brings the knee into full extension.

This procedure makes it possible to choose the right spring for the patient before it is fastened to the brace and eliminates wasteful trial and error methods.

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[1] A New Device for Measuring Muscle Strength, Arch. Phys. Med. 30:234 (April) 1949.

Acknowledgments. — We wish to express our thanks to the Medical Illustration Section (Mr. Robert E. David, Chief, and Mrs. Jeanette M. Whitehorn, Medical Artist), Veterans Administration Hospital, Fort Howard (Baltimore), Maryland, for the preparation of the illustrations.

INTRODUCTION TO PROBLEMS OF EDUCATION THERAPY *

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The importance of education in the training and retraining of the veteran in the post war period has been recognized through the passage of Public Law 346 (G. I. Bill of Rights) and Public Law 16. The educational benefits under these laws, however, cannot be offered to hospitalized veterans. Consequently, the Veterans Administration has inaugurated an educational therapy program which supplements (and in many cases augments) the educational benefits of the above stated laws without affecting the entitlement of a veteran under Public Law 346 and Public Law 16.[1]

The recognition that many hospitalized patients have ample time available leads to the logical step of offering the much needed educational program during their convalescence. Moreover, the provision of education is by necessity a basic feature in the therapeutic approach to total rehabilitation.

The Scope of Education Therapy

"Education Therapy," simply defined, "is the use on medical prescription of educational courses in the treatment of patients to assist in restoring them to the fullest mental and physical capacity compatible with their abilities and disabilities."[2] The scope of education therapy is divided into three major divisions: (1) diversional, (2) vocational, (3) direct therapeutic. Diversional educational therapy implies that a patient merely wishes to satisfy an educational desire. The subjects chosen by the patients are on a leisure time interest basis and do not necessarily involve any educational objective. Nevertheless, it frequently happens that such an approach leads to a distinct educational objective. A characteristic example of a diversional course of study is the current events discussion group, but actually any educational subject could be classified in this category.

Vocational aspects of education therapy generally deal with the following phases:

(*a*) *Retraining.* — Any person who has been absent from his vocation for some length of time because of military service or hospitalization often requires refresher training to regain his original knowledge and skills. Thus, for example, a former bookkeeper would register for courses in bookkeeping and accounting and other related subjects. When a student is hospitalized because of illness for a relatively short period, it often happens that he loses the training time during his hospitalization and is compelled to repeat his courses thereby losing a whole semester. Education therapy can bridge this gap by affording the patient a program that will maintain the continuity of his training.

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Although the phrase "Education Therapy" is used throughout the paper, the term "Educational Therapy" is the official designation for this part of the rehabilitation program in the Veterans Administration.

* Reviewed in the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the authors are the result of their own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

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[1] Veterans Administration Circular, No. 131, May, 1946.

[2] Veterans Administration Technical Bulletin 10 A-116, February 2, 1948.

(*b*) *New Training.* — In contrast to retraining, new training involves preparation for new vocational goals. Under such circumstances patients may be given the opportunity to utilize long term hospitalization to train for a higher level occupation although they could return to their former employment. On the other hand, the nature of certain disabilities may necessitate a change in occupation. The educational program is then adapted to the requirements of the changed occupation. For example, a patient unable to return to his previous occupation as a truck driver because of severely crippling arthritis was trained for the position of dispatcher with an express company. If possible, it is advisable to train the patient for jobs in the same industrial field so that he may be re-employed by his former firm. In very severe disabilities, such as paraplegia and multiple sclerosis, training for home bound industry should be carefully considered.

It is not desired to give the impression that a complete educational or vocational training can be given in the hospital. Much of the training needs to be accomplished after the patient leaves the hospital. However, in-hospital training will not only save time, but can be a considerable portion of the required training.

In-hospital training includes a wide diversity of educational preparation. In some instances a patient may have to finish high high school requirements before he can proceed to training at an advanced level. The high school diploma program is specifically designed to enable the patient to receive credit toward his high school diploma in the light of his educational and vocational objective. To illustrate, a patient interested in a business career will be enrolled in business courses such as Fundamentals of Typewriting and Merchandising Principles which will satisfy credits for his diploma and will also be an initiatory process towards his vocational objective. It should be emphasized that a high school diploma as such is not a vocational goal, but only the fulfillment of a requirement to enter definitive training. Therefore, it is advantageous to complete this program of study in the shortest possible time.

For other patients educational preparation may be directed towards the taking of courses for college credits. Such courses may be taken through the United States Armed Forces Institute, through other correspondence courses approved by the Veterans Administration, or special contract arrangement such as our hospital has with the Boston University General College. In the latter program under the supervision of the education therapy unit, patients, while hospitalized, may enter this college and complete with full credits two years of a college matriculation program. For some patients courses are designed as a direct vocational approach to prepare them for certain entrance examinations such as civil service, specialty schools, and large industrial concerns.

Fundamentally, all educational activities have therapeutic value. The therapeutic value of diversional education therapy is mainly in its psychological approach while vocational education therapy is inseparable from the total medical rehabilitation program. In some cases the main purpose for educational activity is for its direct therapeutic effect. For instance, the initial process in the development of work tolerance among tuberculosis patients is often begun with educational courses. Here, individual instruction methods are used because these patients are confined to their beds; but irrespective of its intended effect, educational courses may be carried on through either individual or group instructional methods. Three examples of group activities, therapeutic in nature, at our hospital would be the music therapy group for psychotic patients, the mathematics class for aphasics conducted in conjunction with language therapy, and the psychology class for the severely handicapped.

The *music therapy group* is conducted as a music appreciation class in which group discussion follows the presentation of recorded music. The responses and reactions of patients in these sessions are carefully charted and analyzed. In addition to the therapeutic value, the observations made are also valuable for diagnostic and research purposes.

The therapeutic value of mathematics for aphasic patients arises from the intellectual restoration of brain function. In these patients with brain lesions the attempt of intellectual restoration is very similar to the process of physical rehabilitation; in both instances the objective is to awaken functions not lost but obscured by the injury and to restore function impaired by the lesion. The extent of the return is governed by the amount of brain damage. However, the limitations cannot be predicted until full use has been made of intellectual rehabilitation to a maximum level. As in the physical rehabilitation of patients with brain lesions, these authors have come to the conclusion that group activity can be successfully employed in education therapy among patients of different intellectual levels provided that there is awareness of the needs of the individuals composing the group.[3]

The psychology class for the severely handicapped is an excellent medium through which these patients can be aided in adjusting to their disability. Insight into the problems that confront them as handicapped individuals is the main objective of the course. Patients should be carefully selected and, if medically feasible, assigned to this course early in their convalescence. It is advisable, if not imperative, that the education therapy unit prepare this course in consultation with the psychiatric, psychological, and medical services.

Education therapy is not limited to any special diseases or disabilities. It can be profitably employed in a great variety of conditions in its diversion-

TABLE 1.

	Diversional	Vocational	Direct Therapeutic
Medical Conditions —			
Diseases of the heart	X	XX	XX
Diseases of the lungs, especially tuberculosis	X	XXX	XX
Diseases of the gastro-intestinal tract	X	X	
Metabolic diseases, especially diabetes	X	X	
Arthritis	X	XXX	X
Surgical Conditions —			
Post-operative recovery	X		
Orthepedic conditions	X	X	
Amputations	X	X	
Neurological Conditions —			
Poliomyelitis	X	XXX	X
Multiple sclerosis, et al	XX	(X)	
Hemiplegia	XX	(X)	
Aphasia	X	(X)	XXX
Paraplegia	X	XXX	XX
Neuropsychiatric Conditions	X	XX	XXX

XXX Greatest value of Education Therapy.
XX Marked value, but of secondary significance.
X Valuable adjunct.
(X) Questionable value.

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[3] Friedland, F., and Margolin, R. J.: Physical Rehabilitation of Patients with Brain Injury. Occupational Therapy and Rehabilitation, Vol. 26, No. 1, Feb., 1947.

al, vocational or direct therapeutic forms. Table 1 illustrates a number of indications for Education Therapy with their values.

Table 2 lists three groups of patients often considered non-feasible for any constructive activity because of their poor prognosis. Considering subjects such as current events discussion and forum activities rather than formal study, education therapy can serve the purpose of making these patients' lives more worthwhile. It is indicated in such a form especially for a selected group of patients who are not capable of accepting any other form of diversional treatment requiring physical exertion.

TABLE 2.

	Diversional	Vocational	Direct Therapeutic
The chronic invalid	X	X	
The domiciliary care patient	X		
The terminal care patient	X		X*

* Education Therapy is morale building and therefore direct therapeutic as a psychological treatment.

In the teaching procedure are two basic techniques of instruction, individual tutoring and group classes. There are certain recognized advantages to conducting group classes. When applicable, it is a great time saving device for the teaching staff, but its economic value is not its chief feature. The learning process of the individual is enhanced by the group situation, which acts as a strong motivating agent. Motivation is often difficult to maintain in a hospital because of the tremendous physical and emotional handicaps of the patient. In class activity, however, these handicaps appear to be diminished by the combined spirit of competition and inspiring acts of individual members. Thus, the class is conditioned to reach for a higher level of aspiration. In education therapy, the informal discussion method characteristic of these classes is desirable for all courses; it is imperative for such groups as current events and voice and diction. In addition to the educational value of group activity, the integration of the above mentioned factors inevitably induces a strong socializing effect.

Notwithstanding the advantages of classes, individual tutoring is necessary in singular situations and has its place in the total program. Because of the wide divergence of needs and interests, it often occurs that a single patient may request a course in an unusual subject and individual tutoring must be given. The same holds true for the more popular courses when at certain times only a single individual may request the course.

In certain conditions individual teaching may also be advisable because of the highly superior or greatly inferior intellectual level of the patient. In some cases discretion indicates the advisability or necessity of individual teaching, for example, where the emotional instability of the patient may be a disrupting factor to the group. Finally, the importance of individual tutoring for the bedridden patient must not be overlooked. In fact, education therapy for the confined patient constitutes a major portion of the total program.

Educational Foundations

Education therapy is by no means different from any other learning process, deriving its impetus from the dynamic drives characteristic of human adjustment. Recent education theory confirms the concept of the continuity of the learning process from birth to death. In our own experience, favorable results in education therapy have demonstrated that learning is possible at any age level. This is extremely significant for the disabled veteran, where the problem of re-education is a serious one. The acceptance of education therapy is determined by three fundamental motivating forces — self motivation, motivation by opportunity, and induced motivation. Self motivation is exemplified by the patient who could not satisfy an educational need of long standing prior to hospitalization because he lacked the time and now is able to do so. Through motivation by opportunity patients are attracted who previously were unaware of the need or the advantages of educational advancement until stimulated through opportunities provided by education therapy. Induced motivation is applied to reach a group of severely disabled patients who do not realize that their vocational future is limited by their disability and is mainly dependent upon adequate educational retraining. Frequently, patients in the latter group lose interest in spite of repeated encouragement by staff members and consequently their educational prognosis is less favorable than those of the other groups.

Whatever the motivation may be, learning is improved when the student feels responsible for his education. When an individual is imbued with a strong drive, namely, motive and purpose, then the best learning situation is present. This is especially evident among adults who generally do not undertake such experiences unless they have an appreciation of the need for studying. Education therapy must be geared to the interests, needs, and problems of the patients.

It logically follows that in education therapy the tempo of learning is adjusted to the potentialities of the patient. Such a procedure is conducive to learning, because it minimizes the frustration element often seen in programs not adjusted to the capabilities of the students. In the last analysis, only the student determines what can be learned. Thus, time limits are not set for any particular course of study. Programs can be short term or long term. One of the more important lessons garnered from our war-time training is that educational training programs can be considerably accelerated. Similarly, if need arises, education therapy can condense over a relatively short period courses which may take much longer in the ordinary school setup. Such need presents itself where the student is a short term patient or when a vocational opportunity is available in the immediate future and requires preliminary intensified preparation.

If the needs, interests, and problems of patients are to be satisfied in education therapy, it must cover every conceivable subject — business, academic, and technical. Also, if education therapy is to reach all types of individuals it must be capable of employing diverse educational methods. It certainly cannot be expected to have all the different types of educational aids available in a hospital; therefore improvisation becomes a prominent technique employed by the instructional staff. Under such circumstances constant readjustment of teaching technique and of program is possible. Implicit is a flexibility of program which would enable a change to another program if the original choice should prove to be inappropriate. In contrast to the relative rigidity of the traditional school system this flexibility not only provides a beneficial therapeutic effect, but it also can be experimentally valuable for research in the educational field.

Careful observation has led to the conclusion that informal teaching procedures create an emotional climate conducive to enhanced learning. The informal atmosphere removes the feeling of pressure that is often characteristic of the usual school situation The total rehabilitation of the individual personality is the chief concern of education therapy. In the light of this fact, achievement of emotional relaxation and stability assumes priority over subject matter; in other words, these patients must be regarded as individuals with personal problems, and education therapy as one of the channels through which assistance may be given in the resolution of these problems.

Whatever objectives in education therapy are established with the patients, the integration of the didactic approach with the practical is a recommended procedure whenever possible. In a hospital situation experimental learning should be identical with a normal way of mature life. There is, thus, a sort of implicit dualism in the learning process whereby patients learn certain things by doing and at the same time learn their conceptual basis through abstract thinking. To illustrate this principle, a student interested in radio repair and servicing must have a fundamental academic background, such as mathematics and physics essential for radio. This teaching should then be augmented by coordination with other therapeutic sections dealing with the manual and practical application of the subject. Non-serviceable old radios can easily be secured through contribution, or small radio kits can be bought inexpensively. Thus a wealth of material and instructional and training aids becomes available to implement an effective curriculum.

Education Therapist

In education therapy, as in any other discipline, the quality of the program is dependent upon the number of teachers available and their ability to develop an effective curriculum. Basically, the full time staff represents the core of the teaching personnel. Because of budgetary reasons it may not be possible to employ a complete staff of education therapists under the customary hospital set-up. Therefore, to assure a well rounded program, the staff must be augmented by volunteers. However, it is of extreme importance that such volunteers have the same basic teaching qualifications as the staff therpists and that they be well oriented towards the program before participating.

Volunteer teachers are selected from various sources. In Veterans Administration hospitals recruitment is carried on mainly through the services of the Red Cross and the various service organizations. However, when such services are not available, volunteer teachers can be secured by directly approaching suitable candidates in the community. The groups from which volunteers are chosen include the following:

1. Former women teachers who left the profession because of marriage.
2. Former teachers that are now employed in other occupations.
3. Individuals who have certain professional and occupational specialties.
4. Teachers with altruistic motives.
5. College students training for the teaching profession.
6. Hospital patients with special skills.

With proper orientation the volunteer teachers can be given specific responsibilities under the direct supervision of the Chief Education Therapist. However, to maintain the scope and continuity of the program, certain obligations must rest with the full time staff. In addition to teaching, these obligations include such various administrative and professional functions as interviewing and registering patients for courses, observing and recording their progress, corresponding with schools and state educational departments, obtaining adequate materials and supplies for teaching purposes, coordinating education therapy with all other functions of the hospital, and supervising the volunteer staff.

All teachers (staff and volunteers) must meet certain basic qualifications. Because of the complexity of the program the teachers must have a good educational background in their field; they must be capable of teaching other people, a capability which develops as a result of teaching experience or from the highly skilled nature of their professional practice, and from an ability to be aware of and to utilize properly the interpersonal and group factors in the learning situation. Fundamental to the success of education therapy is the patience and the enthusiasm with which the program is carried out. Faith and conviction, ability to observe, and good judgment are equally essential because there are many heart-breaking problems to be faced in the teaching of hospitalized patients.

Education Therapy and Adult Education

As a result of the complexities of modern living, its social as well as its vocational aspects, there has been a gradual *recognition that adult education* must play a major role in community life. It stands to reason that a hospital, vital community agency that it is, should carry the responsibility of providing continuity in adult education activity for its resident patients. From this point of view, education therapy is an integral aspect of adult education.

Adult education has been defined by the joint committee of the American Association for Adult Education and the Department of Adult Education of the National Education Association as "educational work designed to help adults to locate and learn to solve their personal or social problems."[4] This implies that adult education is by no means limited to any special age group. At present the predominant emphasis of adult education is upon those age groups up to fifty years of age. However, of increasing importance is the development of educational programs to deal with the problems of the aged. The authors subscribe to the viewpoint presented by Galen Jones, Director, Division of Elementary and Secondary Schools, U. S. Office of Education[5]:

> . . . . Considering only occupational and economic problems, persons over fifty offer the educational institutions of the country a great challenge. They especially need help in making vocational readjustments and in retraining. From other viewpoints, too — citizenship, leisure-time, family living, and health — this age group offers a challenge. In fact, the orientation of our entire culture to the actualities and potentialities of a new age structure in our population awaits major assistance from the schools [and other educative agencies].

It is obvious that the objectives and problems of adult education as stated above are identical with those of education therapy in a hospital. Education therapy for children of school age need not be elaborated upon since incorporating the school in the hospitals and institutions for crippled and disabled children has always been an accepted practice. Likewise, the acceptance of the continuity of education explains the importance for education therapy activities which should be available to all age groups — the old as well as the young adult. To facilitate the realization of these objectives, competent leadership is necessary.

> Leadership in adult education [in a hospital or any other community agency] necessitates teamwork. None of us can work effectively alone.

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[4] Adult Education. Vol. I, No. 1, October, 1950, p. 6.

[5] Federal Security Agency, Office of Education: Education for a Long and Useful Life. Bulletin No. 6, 1950.

> Teamwork on the local, state, national, and international levels must be further developed. We must learn the best ways of working together.[6]

Here there is an indication that there should be greater cooperation and integration between education therapy and outside adult education agencies. It is not always possible for a patient to complete his educational objective in the hospital. Like any other medical care which is divided into hospital treatment and outpatient or home care, education therapy in its long-range aspect must continue after the discharge of the patient. Thus, the adult educational facilities in the community must be introduced to the therapeutic problems of the patient so that these facilities can carry the educational therapy program to its logical conclusion. This emphasizes the need for proper liaison between hospitals and other educational agencies in the community. In the Veterans Administration the regional offices throughout the country carry the responsibility for such liaison services.

Summary

An attempt has been made to introduce some of the major problems of education therapy. The diversional, therapeutic and vocational aspects of education therapy have been discussed, and its relationship to adult education has been emphasized. It is recognized that in this paper some of the problems of education therapy have been mentioned only briefly and should be further elaborated. It is planned to clarify and define all the important problems in subsequent articles. It is hoped that education therapy has been demonstrated to be feasible as well as desirable in all hospitals and is not limited to Veterans Administration and military hospitals.

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[6] Preston, Everett C.: Adult Education, Vol. I, No. 1, October, 1950.

DIATHERMY GENERATORS

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NATIONAL BUREAU OF STANDARDS

WASHINGTON, D. C.

This paper presents some of the work of the National Bureau of Standards on diathermy generators, the preparation of purchase specifications and the examination and testing of diathermy generators for compliance with specifications. After much effort on the part of manufacturers, users, radio consultants and some government agencies, this work led to the development by the diathermy manufacturers of crystal-controlled machines which operate at specific frequencies assigned by the Federal Communications Commission in accordance with regulations proposed by the International Telecommunications Union in 1947. Diathermy interference with communications has accordingly been greatly reduced. Some of the factors involved in this accomplishment are given.

Chronological Résumé

A diathermy, short-wave, or ultra-short-wave generator, as used in electrotherapeutics, consists of a small radio oscillator or generating set which operates in one or more frequency bands. The oscillator circuit employed may be one of the well-known circuits such as the Hartley, Colpitts, or one selected as suitable by a given manufacturer. The power unit may provide unrectified alternating current plate voltage or rectified plate voltage with more or less filtering. Equipped with treatment electrodes and electric cord for connection to the usual 115-volt power line, the device is a small radio transmitter capable of producing interference with radio communication services. Until recently the Federal Communications Commission has had no regulatory powers over the manufacturers and users of these devices, except during World War II when all diathermy generators in this country were required to be registered with the Federal Communications Commission.

A later development was the high-frequency wattmeter[1-2-3-4] for use as a precise indicator of the amount of r-f power applied in a given clinical application. It has been pointed out[5] that while this instrument may function satisfactorily, it is not clinically advisable to treat similar cases with the same output reading, as there are many factors other than power output which the physician must take into account in giving treatment.

As an example of the variation in power output required for treating different parts of the body, the following table is given of values obtained by measurement with a high-frequency wattmeter. Impedances of the body vary with the portion treated, the method of electrode application, the individual, and the frequency, and may range from three to a hundred ohms.[6]

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[1] Mittelmann, E.: Dosimetry in Short Wave Therapy, Arch. Phys. Therapy 18:613, 1937.

[2] Mittelmann, E., and Kobak, D.: Dosage Measurement in Short Wave Diathermy, Arch. Phys. Therapy 19:725, 1938; Electronics 12:52, 1939.

[3] Mittelmann, E., and Holmquest, H. J.: The Useful Power Output of Short Wave Diathermy Apparatus, Quart. Bull. Northwestern University Medical School 14:172, 1940.

[4] Osborne, S. L., and Holmquest, H. J.. Technique of Electrotherapy, C. A. Thomas, Springfield, Ill., 1941, p. 160.

[5] Schmitt, M. G.: Optimal Dosage in Short Wave Diathermy, Arch. Phys. Ther. 21:716, 1940.

[6] Gieringer, C. K.: Short-Wave Diathermy Apparatus and Frequency-Control Possibilities, Elec. Eng. 59:429, 1940.

Total Power Input Measured with a High-Frequency Wattmeter.

Treatment	Application	Watts
Head	12-inch Disk	20-35
Chest	12-inch Disk	35-70
Pelvis	12-inch Disk	50-75
Back (Lumbar)	3-turn Pancake	45-85
Lower Extremity	Long Single Loop	80-110

Diathermy or short-wave generators have the undesirable characteristic of causing interference[7-8-9] with radio communications. Most machines of this kind were constructed to operate at some frequency in the range from about 10 to 50 megacycles (Mc.) with the majority operating around 17 megacycles. The frequency of operation varied considerably from one machine to another but means were available for obtaining satisfactory clinical operation. The frequency of operation was affected by the type and position of the applicators upon the patient's body. Breathing of the patient often periodically altered the relative positions of the electrodes and caused the output frequency to vary back and forth across a considerable frequency range in step with the patient's breathing. The patient's electrodes had two leads three or four feet long, or a cable ten to twelve feet long. The oscillator was not shielded, often being in a wooden cabinet, and r-f filters on the power line were unknown. While the combination represented a poor radio transmitter and antenna, these devices were responsible at times for much interference with urgent radio reception and annoyance in reception of television and other programs. Interference was not confined to local areas alone but was at times distributed to great distances[10] by the electric power lines. The situation became so bad that in 1939 the Federal Communications Commission called a conference in New York City of physicians, diathermy manufacturers, radio engineers and other interested parties to consider what should be done to alleviate the interference.

The right of the physicians to employ this means of treating human ills was recognized by the Federal Communications Commission as well as the fact that intolerable radio interference was being caused by these electromedical devices. The interference could be overcome in two ways, by shielding the diathermy treating room, or by assigning specific frequencies for operation of these devices and moving other radio services from these bands. The Government of Canada assigned 13,660 kc and its second and third harmonics for this service. The shielding proposal was considered too expensive, as well as impractical for hospital use.

The next year (1940) a conference was held in Washington at which suitable frequencies for diathermy use were stated by the physicians and diathermy manufacturers. The latter agreed to build diathermy generators with a frequency tolerance of 0.5 per cent, but felt that the reduction of this tolerance would result in greatly increased cost of the machine. Crystal control was advocated as a means of maintaining frequency within the narrow limits demanded by the crowded frequency spectrum. Since crystal control was used on broadcast and communications transmitters, it was argued that diathermy generators should be similarly controlled. A frequency tolerance

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[7] Krusen, F. H.; MacEachern, M. T.; Desjardins, A. U., and Mathis, A. W.: Medical Viewpoint of Interference with Radio Reception by Electro-Medical Equipment, Arch. Phys. Ther. 20:261 (May) 1939.

[8] Jett, E. K.: Radio Interference Problems from Operation of Electro-Medical Apparatus, Arch. Phys. Ther. 21:655 (Nov.) 1940.

[9] Radio Interference from Electro-Medical Apparatus, Radio Craft 12:627 (Apr.) 1941.

[10] Interference Source Discovered, Electronics 9:19 (Feb.) 1936.

of 0.05 per cent was suggested by the Federal Communications Commission.

A special committee was set up in 1941 to determine what frequency tolerance was possible both from the clinical and an engineering standpoint. Several diathermy generator manufacturers agreed to submit experimental machines to hold frequency to 0.5 per cent. The Council on Physical Therapy (now Council on Physical Medicine and Rehabilitation) of the American Medical Association agreed to test the generators for their adequacy in clinical operation. The National Bureau of Standards agreed to make tests to determine the frequency tolerance in customary operation and other characteristics. Frequencies of 13,660, 27,320 and 40,980 kilocycles were tentatively assigned for these tests.

The tests at the National Bureau of Standards were made in cooperation with a representative of the Council on Physical Medicine and Rehabilitation who arranged with the Director of the Physical Therapy Department, Walter Reed General Hospital, for the assistance of a physician, a physical therapist, and a subject. Treatment electrodes were applied to the subject using several customary techniques, and the frequency of the generator was measured. All dial settings and meter readings of the diathermy generator were recorded for further use. All machines submitted (six for a frequency tolerance of 0.5 per cent and three for 0.05 per cent using crystal control) met the therapeutic and electrical requirements for which they were designed. It was thus demonstrated that diathermy generators could be constructed to maintain frequency within 0.05 per cent for all types of customary treatment. These machines were experimental models and did not yield cost information, which for crystal controlled models had been claimed to be two or three times that of the ordinary machines. Experimental work at this time was handicapped by scarcity of strategic materials and components.

The Surgeon General, U. S. Army, requested assistance of the National Bureau of Standards in the preparation of a purchase specification for diathermy generators for Army use. The specification developed was noteworthy in that it required operation at definite prescribed frequencies with minimum tolerance as suggested by the Federal Communications Commission. The only practicable way in which these requirements could be met was by the use of crystal-controlled generators such as had been demonstrated to be feasible. A large number of diathermy generators was purchased for operation at 13,660 kilocycles.

The Federal Specifications Board submitted a proposed federal specification for diathermy generators, which followed the army specification very closely. This was issued January 21, 1943, as "Federal Specification for Diathermy Apparatus; Short-Wave," W-D-286. Because of the war, procurement of diathermy generators from these specifications was limited to the Armed Services.

During the war the Federal Communications Commission was urged by some manufacturers of diathermy equipment, industrial heating equipment, and other radio-operated devices to assign frequencies such as those already being used, but with much larger tolerances. Other manufacturers questioned the legality of the Commission's insistence on close frequency control of diathermy or other services not used in radio communications.

After holding public hearings, the Federal Communications Commission in 1946 promulgated regulations relating to the operation of medical diathermy and industrial heating equipment. These regulations provided for type approval of a manufacturer's diathermy model following successful passing of certain tests conducted by the Federal Communications Commission. A number of such type approvals were made.

In 1947, the International Telecommunication and Radio Conferences at Atlantic City reassigned frequencies on a world-wide basis. The reassignment shifted frequencies for diathermy and other uses somewhat. The frequencies based on 13,660 kilocycles, in use in Canada and the United States, were shifted to 13,560, 27,120 and 40,680 kilocycles, with permissible deviations of ±0.05, ±0.6, and ±0.05 per cent, respectively. The Federal Communications Commission issued regulations[11] making these frequencies and tolerances mandatory by June 30, 1952, unless a machine was to be operated within a special screened enclosure. In such a case certain tests were prescribed to insure that radiation at any frequency would not exceed an electric field of 15 microvolts per meter at a distance of 1,000 feet. A station license is required for such operation. No license is required for operation of machines having type approval.

In order to satisfy certain objections raised in public hearings preceding the adoption of the rules and regulations, the Federal Communications Commission's laboratory at Laurel, Maryland, designed and built a diathermy generator[12] meeting the requirements of the new regulations. The unit was built for operation at 27.32 megacycles using an electron-coupled power oscillator. Economy and simplicity were important considerations in its design. Tests by the Council on Physical Medicine and Rehabilitation indicated satisfactory therapeutic performance but the power output was approximately 25 per cent lower than the federal specification.

During World War II the Army procured about 3,000 diathermy units, the Veterans Administration about 200 units, and some 500 units were sent abroad under the Lend-Lease plan. The Army units were used in its hospitals here and abroad. Following the war the Army diathermy units were returned from field hospitals, and several hundred were taken by the Navy and the Veterans Administration and some state rehabilitation centers on a surplus disposal program. These machines had given reliable service except for tube failures and slight electrical adjustments. Tubes produced since the war have been practically free from failures for the normal life of the tube. Some of the troubles such as tube failures and the readjustments were caused by rough handling of tubes and machines. The Army was left with about a million dollars worth of first-class diathermy equipment declared to be unlawful after June 30, 1952, in its present condition. In 1949 the Department of the Army accordingly undertook an investigation of the possibility of modification of these diathermy units to comply with the new Federal Communications Commission regulations. The Federal Communications Commission and the National Bureau of Standards cooperated with the Department of the Army. Modification of a sample machine by Federal Communications Commission engineers demonstrated the feasibility of technical changes to enable the machine to meet the new requirements. Relatively few new parts are necessary, but considerable time is required for mechanical and electrical changes. If Army technicians do the work, it appears that the Army's salvage program would save a large sum by modifying the present units instead of purchasing new ones.

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[11] Federal Communications Commission Rules and Regulations, Part 18. Rules and Regulations Relating to Industrial, Scientific, and Medical Service. Effective June 30, 1947.

[12] Chapin, E. W.; Roberts, W. K., and Mobley, M. C. FCC Diathermy Design for Low Harmonic Radiation and Good Frequency Stability, Trans. AIEE 67:12, 1948.

The same modification plans could be used by the Department of the Navy, which could save a proportional amount. It is understood that the Veterans Administration expects to have their radio technicians make the necessary modifications so that the present machines will comply with the new rulings.

Testing of Diathermy Generators

Upon receipt in 1938 of the first request for examination and test of diathermy generators for compliance with purchase specifications, it became necessary to establish test facilities and procedures. Determination of the adequacy of such generators from a clinical standpoint was outside the scope of the Bureau. As advertising emphasis at this time was upon the power output and not the frequency, instrumentation for high-frequency measurement up to 500 watts at 50 megacycles was required. Three methods of power adequacy measurement were in use at this time: (a) A method using a living subject as carried out by the Council on Physical Therapy (now Council on Physical Medicine and Rehabilitation); (b) a calorimeter method involving the temperature rise in a container of saline solution as used by the Department of Hospitals of the City of New York[15]; (c) a photoelectric lamp-load method, often used in measurements of the power output of radio transmitters[14-15] because of its simplicity, and also used by The Department of Hospitals of the City of New York. A fourth possibility was the familiar I^2R method, for which so many objections could be cited, that, although tried experimentally because of use by one of the manufacturers, it was not considered suitable.

Method (a), as conducted by the Council on Physical Therapy, requires the services of a surgeon and several healthy subjects. In this method[16] a cannula is introduced at the midpoint of the anterior surface of the thigh, and inserted about two inches. A thermocouple is placed in the cannula and temperature readings are taken before and after a twenty-minute diathermy application. A final temperature of 104 degrees F. is required. Tests are made using the various electrodes supplied with a given machine.

Method (a) is expensive, time-consuming, also painful and inconvenient for the subjects, but does demonstrate the ability of the machine to raise the body temperature. Cognizance of these undesirable features is perhaps indicated by the fact that now the Council also accepts data taken using methods (b) and (c), when conducted under certain conditions.

Method (b) could be made to give high accuracy in results, but the time required was found to be excessive. A calorimeter method[3] was suggested as giving a better indication of the heating ability of the diathermy machine than method (c). The calorimeter "phantom" usually consisted of a cylindrical or rectangular glass container holding 4 liters of a 0.25 per cent sodium chloride solution which is reported to have an impedance similar to the body. However, such a homogeneous solution does not resemble a cross-section of the human body containing many types of tissues such as fat, muscle, tendons, bone, with blood and other liquids.

A phantom containing two liquids in separate concentric cylinders was

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[13] Titus, Norman E. Technical Problems of Short Wave Diathermy, Arch. Phys. Therapy 19:690 (Nov.) 1938

[14] Pession, G, and Gorio, T. Measurement of Power and Efficiency of Radio Transmitting Apparatus, Proc. IRE 19:377, 1931.

[15] Taylor, A. H. Measurement of Radio Frequency Power, Proc. IRE 24:1342, 1936.

[16] Beard, Gertrude Short Wave Medical Diathermy, Physiotherapy Review 16:3, 1936.

described later[17] and appears to be a better substitute. The outer cylinder contained a vegetable oil and the inner cylinder the salt solution. This form and the overall dimensions were intended to approximate the human adult thigh with its outer fatty tissue. As authorities agree that the chief function of short-wave diathermy treatment is the production of heat deep within the body, the treatment method used should be such as to produce this result. When the induction cable was wound about the phantom and a frequency of about 12 megacycles[17] used, it was found that the inner cylinder of salt solution showed twice the temperature rise in 20 minutes as the outer cylinder of oil. When the space plates (electric field) were used, the outer cylinder of oil showed three times the temperature rise in 20 minutes as did the inner salt solution. This experiment showed that the electromagnetic field (cable technique) produced the greatest temperature rise in the central portion of the phantom corresponding to the vascular tissues. Using the electric field (space plate technique) greater heat was produced in the outer portion of the phantom, corresponding to the fatty tissues. It was accordingly stated that in clinical use the cable technique with the lower frequency would produce greater internal heating and less surface heating, and that the pad or space plate technique would produce less internal heating and more surface heating. The latter would indicate a greater possibility of producing surface burns or blisters because of perspiration. Space plate technique will give deep tissue heating if correctly applied,[18] but the cable technique is preferred, as it is simplest and is less liable to produce burns.

Method (c) appeared desirable for use by the National Bureau of Standards because it was given as the test method in the purchase specification, was convenient, quickly done, and believed to be of adequate accuracy. As previously mentioned it was one of the two test methods then in use by the Department of Hospitals of the City of New York.[13] There an output of 300 watts was required as demonstrated by brilliant lighting of two calibrated 150-watt, 32-volt incandescent lamps in parallel. This represented a load of about 3.4 ohms. This general method was adopted by the National Bureau of Standards.

The method has its critics, who deny the efficacy of lamp load tests as an indicator of a diathermy generator's worth. They[3] point out that many diathermy generators are made with an output impedance near that of the larger 115-volt light bulbs, while the body impedances for many kinds of treatment are much lower. A machine designed with a lower output impedance might be more efficient in clinical operation, yet be rejected because of failure to meet a given power output beyond its range, based upon incandescent lamp tests. To overcome this objection, the National Bureau of Standards selected some other lamp loads having lower impedances than the 115-volt types. Lamp loads used at the National Bureau of Standards for a 200-watt output were as follows:

Lamp Rating		No. of Lamps	Connection	Load Impedance at 60 c/s, Ohms
Watts	Volts			
100	32	2	Parallel	5
100	32	2	Series	20
300	115	1	....	37
200	115	1	....	65

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[17] Holmquest, H. J., and Mittelmann, E.: A Physical Method of Determining the Useful Output of Short Wave Diathermy Apparatus, Quart. Bull., Northwestern Univ. Med. School 15:255, 1941. Technique of Electrotherapy, p. 471.

[18] Coulter, John S., and Osborne, S. L.: Physiologic and Clinical Effects of Short Wave Diathermy, Jour. Med. Cincinnati 18:283 (Aug.) 1937.

Some diathermy machines will light a 300-watt, 115-volt lamp to full brilliancy, while another smaller machine might not light the lamp more than a dull red. Thus the prospective purchaser might be led to believe that the larger machine was the better product because of superior power. It is probable that the larger machine could furnish much more power than a patient could tolerate, although perhaps not as efficiently; as this question has not yet received much attention.

The first tests at the National Bureau of Standards in 1938 required that outputs of about 500 watts at 50 megacycles be demonstrated by a photoelectric method. A 500-watt, 115-volt incandescent lamp was debased and used for the load. A suitable photoelectric cell* was used to indicate the light intensity of the lamp on a direct-current microammeter. The microammeter was calibrated in terms of known 60-cycle power applied to the lamp. The lamp was then coupled to the patient circuit of the diathermy generator and the power expended in the load was determined. Magnetic coupling was used in the case of the cable and drum applicators, a 3-turn spiral coil being connected to the lamp terminals. Electrostatic coupling was used for the pad and space plate applicators. Each pad or space plate was mounted directly above a flat metal plate fastened on insulators and connected to the lamp terminals. A variable air condenser was found to be advantageous in the load circuit when testing some applicators. Since in clinical use the various applicators are separated from the body by toweling, felt spacers, or otherwise, the tests were conducted with several spacings between the applicators and the pick-up circuit.

The use of calibrated incandescent light bulbs as a load for measurement of a few hundred watts of output is subject to technical difficulty and possibilities of error. The error will increase as the frequency and the inductive reactance are increased. For example, the use of a 500-watt, 115-volt incandescent lamp to show a 500-watt output at the order of 50 megacycles is quite difficult practically and liable to large error. The diameter and length of filament wire required are such as may result in unequal heating of part of the filament at 50 megacycles. While the photoelectric cell is located several feet distant and the overall light intensity is not appreciably affected, the formation of a current maximum may alter the calibration by causing the filament to sag, or even to destroy the filament or a heavy lead wire to the filament. If the frequency is reduced to 13 magacycles the difficulty and errors mentioned above are much reduced. If the power is also reduced to 200 watts, the use of several types of incandescent lamps is possible. For lower power it is possible to obtain several impedance values which compare favorably with impedances measured for various parts of the body. Some low impedances can thus be set up, for which a prescribed minimum output, such as 200 watts, can not be demonstrated on some machines. Since the body cannot tolerate such power, there may be a question as to the reason for setting the power requirement even this high. Power output of 150 to 200 watts is desirable for fever therapy.[19] Also it was felt that the machine should be more than adequate to perform satisfactorily eight hours per day in government clinics and hospitals without failure. Reduction in power requirements might open the way for irresponsible persons to manufacture machines of inadequate performance, servicing, parts replacement and other features. The enactment of the Federal Communications Commission rules has perhaps removed some of these considerations.

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* At least two companies manufacture a photoelectric cell which will operate the meter mentioned without an amplifier.

[19] Osborne, and Holmquest: Technique of Electrotherapy, C. A. Thomas, Springfield, Ill., 1941, p. 445.

The requirement of several sets of incandescent lamp bulbs of various impedances led to the provision of interchangeable lamp mountings in a convenient form for the test. Each bulb was debased and mounted horizontally on a small wood base which could be placed at a given point between suitable retaining blocks. The wire leads of the bulb had soldering lugs attached that could readily be placed under a binding-post assembly, to which one of several interchangeable loops of wire were fastened. The photoelectric cell was in line with the light bulb and at such a distance that the direct-current meter would give a large deflection for any lamp load of 200 watts. A lamp bulb could be calibrated, be removed, and be replaced without altering its calibration. This was convenient, rapid, and permitted all bulb combinations to be calibrated consecutively before testing the diathermy generator. For most tests the maximum output of the generator was not determined as long as it exceeded the requirement of the specification.

Frequency stability tests were of great importance during some of the earlier tests mentioned above. Measurements during clinical applications of various treatment electrodes were made with a heterodyne frequency meter. This instrument was used to measure the change in frequency when a machine was operated for an extended time on lamp load.

A limited number of measurements on the harmonic frequencies of seven diathermy generators were made in 1941 for the Federal Communications Commission. The generators operated into a lamp load with adjustments to give meter readings such as observed in clinical tests previously recorded. Using a closely coupled sensitive indicator, harmonics up to about 300 megacycles were found on two generators, up to 164 megacycles on one, up to 137 megacycles on three, and up to 96 megacycles on one. Field intensities were measured for one condition for harmonics up to 122 megacycles, which was the limit of the measuring equipment then available. These measurements tended to verify complaints which had been made of diathermy interference at many frequencies.

The Federal Communications Commission regulations becoming effective July 1, 1952, place a limit for harmonic outputs of 25 microvolts per meter at a distance of 1,000 feet or more. For the Federal Communications Commission type tests the diathermy generator is placed on a turntable so that the field in all directions from the generator can be readily measured. Excessive harmonic radiation can, of course, be eliminated by simple changes within the generator, which also reduce the power output so that the machine may no longer be effective for its intended clinical use. The Council's approval would be based upon the normal power output.

In the work previously done for the Federal Communications Commission the diathermy generators were first submitted to and found to be adequate clinically by officials of the Council on Physical Therapy,A. M. A., before being subjected to radio tests at the Bureau. Earlier, type tests on radio station frequency monitors[20] made by the Bureau for the Federal Communications Commission were undertaken only on units adjusted by the manufacturer to show a station frequency of 1500 kc correctly. This procedure demonstrated the manufacturer's ability to accurately adjust his product to the desired frequency. In one case, use of the Bureau's standard for adjusting an instrument to frequency was requested but was not given on the basis that if an accurate frequency adjustment were lacking on the sample brought to the Bureau, instruments sold to broadcast stations might not be accurately adjusted.

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[20] George W. D.: The Testing of Frequency Monitors for the Federal Radio Commission, Proc. IRE 22:449, 1934.

In order to protect both manufacturer and user, type approval should be considered only for a manufacturer whose machine has been tested and proved adequate in clinical operation. Then, without alterations of any kind, it should be operated at maximum output and tested for compliance with radio regulations. A machine meeting these requirements would be given type approval. All machines constructed in accordance with that particular type would be expected to be free of undesired radiation and be clinically adequate. The 200-watt output representing a "factor-of-safety" of 2 to 5 or larger in the tests versus most clinical use would further safeguard and reduce probability of interference by hospitals, clinics, and private physicians employing these machines.

It is noteworthy that the reduction or elimination of interference from medical diathermy generators, together with promulgation of a Federal specification, have been accomplished through cooperative efforts by a number of groups including the physicians or users of the generators (Council on Physical Medicine and Rehabilitation), certain manufacturers of diathermy equipment, and numerous government agencies such as the Federal Communications Commission, Physical Therapy Department of Walter Reed General Hospital, former Procurement Division of the Treasury Department, Veterans Administration, The Surgeon General's Office, Federal Specifications Board and National Bureau of Standards.

ARCHIVES of PHYSICAL MEDICINE

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.·. EDITORIAL .·.

AMERICAN BOARD OF PHYSICAL MEDICINE AND REHABILITATION

The next examinations for the American Board of Physical Medicine and Rehabilitation will be held in Chicago, June 8 and 9, 1952. The final date for filing applications is March 31, 1952. Applications for eligibility to the examinations should be mailed to the Secretary, Dr. Robert L. Bennett. Georgia Warm Springs Foundation, Warm Springs, Georgia.

ETHICAL RELATIONSHIPS BETWEEN PHYSIATRISTS AND INSTITUTIONS

For several years, various committees of the American Medical Association and the Board of Trustees of that association have been giving careful study to the relationships between hospitals and other institutions on the one hand and certain groups of physicians on the other hand. The groups of physicians particularly involved in these studies have included not only the specialists in physical medicine but also specialists in clinical pathology, roentgenology and anesthesiology. After prolonged study, the Board of Trustees of the American Medical Association recommended that there be substituted for all previous reports a new report which should serve as a guide for the conduct of physicians in relationships with institutions.

At the meeting of the House of Delegates of the American Medical Association held in Los Angeles in conjunction with the clinical session of that association in December, 1951, this statement was approved unanimously.[1] It is of such great importance in guiding physiatrists in their relationships with institutions that it seems wise to publish the statement herewith in full. It reads as follows:

"*Guides for conduct of physicians in relationships with institutions.*

'So far as it can be determined on the basis of study made by the Bureau of Legal Medicine and Legislation of the American Medical Association, as a matter of law the corporate practice of medicine is illegal in most states. In almost all instances the classic example given by the courts of the type of corporate practice of a profession that is illegal is the instance in which a corporation hires a professional man and then sells his services to the public on a fee basis for the profit of the corporation. Such exceptions as there are refer to statutory legislation in several states permitting certain modifications of this general law. It must also be remembered that fee splitting with a corporation is just as unethical as fee splitting with another physician.

'In addition to being guided by the laws of the various states, physicians in their relationships with hospitals must be guided by the Principles of Medical Ethics of the American Medical Association. Those sections of the Principles which have a distinct bearing on these relationships are as follows:

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[1] Report of Reference Committee on Hygiene and Public Health, J. A. M. A. 147:1684 (Dec. 22) 1951.

'Chapter I, Sec. 3. 'Groups and Clinics. — The ethical principles actuating and governing a group or clinic are exactly the same as those applicable to the individual. As a group or clinic is composed of individual physicians, each of whom, whether employer, employee or partner, is subject to the principles of ethics herein elaborated, the uniting into a business or professional organization does not relieve them either individually or as a group from the obligation they assume when entering the profession.'

'Chapter III, Article VI, Sec. 2. 'Conditions of Medical Practice. — A physician should not dispose of his service under conditions that make it impossible to render adequate service to his patients, except under circumstances in which the patients concerned might be deprived of immediately necessary care.'

'Chapter III, Article VI, Sec. 3. 'Contract Practice. — Contract practice as applied to medicine means the practice of medicine under an agreement between a physician or a group of physicians, as principals or agents, and a corporation, organization, political subdivision or individual, whereby partial or full medical services are provided for a group or class of individuals on the basis of a fee schedule, or for a salary or for a fixed rate per capita.

'Contract practice *per se* is not unethical. Contract practice is unethical if it permits of features or conditions that are declared unethical in these Principles of Medical Ethics or if the contract or any of its provisions causes deterioration of the quality of the medical services rendered.'

'Chapter III, Article VI, Sec. 6. 'Purveyal of Medical Service. — A physician should not dispose of his professional attainments or services to any hospital, lay body, organization, group or individual, by whatever name called, or however organized, under terms or conditions which permit exploitation of the services of the physician for the financial profit of the agency concerned. Such a procedure is beneath the dignity of professional practice and is harmful alike to the profession of medicine and the welfare of the people.'

'In conclusion, the Principles of Medical Ethics states: 'These principles of medical ethics have been and are set down primarily for the good of the public and should be observed in such a manner as shall merit and receive the endorsement of the community . . .'

"The duties of the Judicial Council are specified in the Constitution and By-Laws and among those duties the following is prescribed:

" 'The Council shall have jurisdiction on all questions of medical ethics and the interpretation of the laws of the Association.

" 'The Council at its discretion may investigate general professional conditions and all matters pertaining to the relations of physicians to one another and to the public, and may make such recommendations to the House of Delegates or the constituent associations as it deems necessary.

" 'The Council shall have authority to request the President to appoint investigating juries to which it may refer complaints or evidence of unethical conduct which in its judgment are of greater than local concern. Such investigating juries, if probable cause for action be shown, shall submit formal charges to the President, who shall appoint a prosecutor to prosecute such charges against the accused before the Judicial Council in the name and on behalf of the American Medical Association. The Council may acquit, admonish, suspend or expel the accused.'

"The primary obligation of both physicians and hospitals is to serve the best interest of the patients. The decision as to the ethical or unethical nature of practice must be based on the ultimate effect for good or ill on the public as a whole. All of the various questions involved in the relationship between physicians and hospitals, both legal and ethical, particularly questions dependent on local conditions, must be considered in the first instance at the local level because of the various differences which of necessity exist in the many sections of the country.

"One of the factors that have aggravated physician-hospital relationship is the inclusion of medical services in the contracts of voluntary hospital service plans. The medical profession is fostering voluntary health insurance, and we believe that nothing should be done to disturb this very important and essential program. However, the American Medical Association has reaffirmed many times through its then Bureau of Medical Economics, its Judicial Council and the House of Delegates the principle that hospital service plans should exclude all medical services, and the contract provisions of such plans should be limited exclusively to hospital services. At the same time, so that there would be no misunderstanding as to which services should or should not be included, the House of Delegates has stated that '. . . if hospital service is limited to include only hospital room accommodations, such as bed, board, operating room, medicine, surgical dressings and general nursing care, the distinction between hospital service and medical service will be clear.' (Proceedings of the San Francisco Session of the House of Delegates, 1938, p. 31.) Past actions of the House of Delegates give every reason to reiterate that radiology, anesthesiology, pathology and physiatry constitute the practice of medicine.

"In order to initiate a method for remedying this situation, it is recommended that Blue Shield and Blue Cross be requested to cooperate to the extent of writing all new contracts in such a manner that Blue Shield will cover insurable medical services and Blue Cross will cover insurable hospital services. It is hoped that the professional and hospital authorities and the voluntary prepayment plans will cooperate in furthering these recommendations.

"Since the physician and hospital are interdependent, it is incumbent on both to be interested in all phases of their scientific and financial relationships. This means that the professional staff of the hospital has very definite responsibilities toward not only other members of the professional staff, whether active or courtesy, but also toward hospital management. The recommendations of the staff concerning medical matters are usually accepted by the management of the hospital through its board of managers or trustees. It must also be remembered that to be approved for residencies in specialties by the American Medical Association and the American College of Surgeons, certain requirements are mandatory to the institution, among them adequate pathologic and radiologic coverage. As a rule, the staff of a hospital elects an executive committee or works under an appointed executive committee to advise the lay officers of the institution purely on professional matters, and recommends who may or may not use the institution for professional work. Unfortunately, in many instances, the financial problems of the lay hospital management have been no affair of the staff or of its professional executive committee. This is wrong and probably the cause of most of the differences of opinion between physicians and hospital management. The financial problems of an institution in which a physician does his professional work are definitely of importance to him and to the professional staff. Proper consideration must be given to these problems if the hospital is to work efficiently and remain the workshop of the physician; without proper facilities the services rendered to the public are in jeopardy and these public services are the all-important function of both hospital and staff.

"Every professional man on the appointed staff should have a voice in the professional management of the institution. The pathologist, roentgenologist, anesthesiologist and physiatrist, as well as the other professional staff members, should have equal standing as active members of the staff with all the rights and privileges pertaining to other members of the staff of equal standing. The chiefs of these departments should be nominated and appointed in the same manner as are the chiefs of other major departments in the same hospital.

"The revised Principles of Medical Ethics has been written with all of these various factors in mind and is broad enough to cover all possible ethical physician-hospital relationships. The Constitution and By-Laws of the American Medical Association distinctly covers methods of procedure for all persons who have a complaint so that they may approach the Judicial Council. The functions of that Council are specifically delineated;

" 'In the event of a controversy between physician and physician, or physician and hospital management, on these problems, it is recommended that, since local conditions must be taken into consideration, these problems be resolved insofar as possible at the local level.

" 'There can be no exploitation of the doctor or of the hospital if everyone concerned in management and on the professional staff will work together to supply the greatest possible good quality medical and hospital services to the public. In any given controversy, every effort should first be made to settle the matter at the staff-management level. In case of failure to settle the controversy at this level, assistance of the county medical society should be requested. If, then, it cannot be resolved it should be submitted to a committee of the state medical association for advice and recommendation. If problems cannot be solved at the staff-management level, through the county medical society, or through the state medical association, the Constitution and By-Laws of the American Medical Association provides that '. . . the (Judicial) Council, at its discretion, may investigate general professional conditions and all matters pertaining to the relations of physicians to one another and to the public, and may make such recommendations to the House of Delegates or the constitutent associations as it deems necessary.'

"To implement the settlement of such controversies, it is recommended that each component medical society and each constituent state and territorial medical association appoint a Committee on Hospital and Professional Relations. This committee should be available to receive complaints from any physician, hospital, medical organization, or any other interested person or group with reference to professional or economic relations existing between doctors of medicine and hospitals. On receipt of such complaint by such a committee the matter should be investigated and acted on in such manner as will best effect adjustment of the complaint.

"Another approach that should not be neglected in activating this report is that of the local and state hospital associations. Most of the states and many communities have hospital associations providing direct representation for the hospitals within their areas. It seems reasonable to assume that state medical associations and component county medical societies could well effect liaison with these organizations in the settlement of problems involving physician relationships.

"In summary, the following general principles are suggested to individual physicians, county medical societies, and state medical associations as a basis for adjusting controversies, these principles, however, to be qualified to the extent required by the applicability of one or more of the factors heretofore mentioned:

"1. A physician should not dispose of his professional attainments or services to any hospital, corporation or lay body by whatever name called or however organized under terms or conditions which permit the sale of the services of that physician by such agency for a fee.

"2. *Where a hospital is not selling the services of a physician, the financial* arrangement if any between the hospital and the physician properly may be placed on any mutually satisfactory basis. This refers to the remuneration of a physician for teaching or research or charitable services or the like. Corporations or other lay bodies properly may provide such services and employ or otherwise engage doctors for those purposes.

"3. The practices of anesthesiology, pathology, physical medicine and radiology *are an integral part of the practice of medicine in the same category* as the practice of surgery, internal medicine or any other designated field of medicine."

MEDICAL NEWS

Members are invited to send to this office items of news of general interest, for example, those relating to society activities, new hospitals, education, etc. Programs should be received at least three weeks before the date of meeting.

Kenny Certificates Awarded

Fifteen registered nurses and physical therapists from seven states and two foreign countries were awarded certificates as graduate Kenny Therapists in the treatment of infantile paralysis. Dr. Miland E. Knapp, chief of physical medicine in charge of therapist training for the Foundation, presented the certificates.

They were among a group of 48 trainees, the largest class to be in training as student Kenny Therapists since Kenny Institute, the Kenny Foundation's International Kenny Therapist Training Center, was opened in 1942.

Designed to qualify trainees to become Kenny Therapists, a new 24-month course will be opened to registered nurses and physical therapists at Kenny Institute in June, 1952. Application blanks for Kenny Therapist training scholarships for nurses and physical therapists are available by writing to Director of Training, Sister Elizabeth Kenny Foundation, 1800 Chicago Avenue, Minneapolis 4, Minnesota.

Repeating Polio Courses in 1952

Aided by a grant from the National Foundation for Infantile Paralysis, the Orthopaedic Hospital of Los Angeles, California, announces short courses in Poliomyelitis-team approach to the total treatment of the patient, to be given February 11-15, May 19-23, and in October (dates to be announced).

Courses are designed to present all phases of patient care with emphasis on coordination of services. They are open to physicians, nurses, physical therapists and occupational therapists. For further information, contact Miss Miriam Thompson, OTR, Director of OT, Orthopaedic Hospital, 2400 South Flower Street, Los Angeles 7, California.

National Institute Awards

The National Institute of Neurological Diseases and Blindness of the Public Health Service, in addition to awarding research grants and fellowships, now has funds available for traineeships in the field of rehabilitation. These traineeships are to be awarded to those who are qualified and interested in the principles and practice of total rehabilitation of the disabling diseases. Traineeships will be extended to neurologists, psychiatrists, orthopedists, pediatricians, internists and other professional personnel. Training will be conducted in recognized rehabilitation centers throughout the country. All inquiries should be addressed to Dr. Pearce Bailey, Director of the National Institute of Neurological Diseases and Blindness, National Institutes of Health, Bethesda, Maryland.

Exhibit on Noise

At the Clinical Session of the American Medical Association held in Los Angeles, The Council on Physical Medicine and Rehabilitation presented an exhibit demonstrating the danger of noise as a health hazard.

(Continued on page 43)

Members
Standing Committees of the American Congress of Physical Medicine
1952

Advances in Education

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Donald L. Rose, M.D.
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Membership

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Nominating

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Problems Affecting Physical and Occupational Therapists

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Harriet E. Gillette, M.D.

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Edward H. Lowman, M.D.
Oscar O. Selke, Jr., M.D.
Charles Stansky, M.D.

Awards for Scientific Exhibits

William H. Schmidt, M.D., Chairman.
Earl C. Elkins, M.D.
H. Worley Kendell, M.D.
Charles O. Molander, M.D.

(*Continued from page 41*)

Rehabilitation Association Formed

The Minnesota Rehabilitation Association was formed recently to promote the welfare of the handicapped through improvement of standards of professional workers who serve them by encouragement of adequate facilities for treatment, education and rehabilitation; education of the community to problems of the handicapped, and sponsorship of programs that advance their welfare.

Postgraduate Continuation Courses in Physical Medicine

Jewish Sanitarium and Hospital for Chronic Diseases — Clinical Rehabilitation — April, 10 weeks.

Kings County Hospital, Physical Medicine and Rehabilitation — April, 6 weeks.

New York Polyclinic Medical School and Hospital — Physical Medicine and Rehabilitation — Arranged, 4 weeks.

For additional information, write to Council on Medical Education and Hospitals, American Medical Association.

National Society Reports for 1951

Mr. Lawrence J. Linck, Executive Director of the National Society for Crippled Children and Adults, announced that services and facilities offered crippled children through the nation's Easter Seal societies reached an all-time high in 1951.

The total of professional persons trained for specialized work with the crippled under scholarships, fellowships, grants and workshops of the Easter Seal societies reached 700.

National Society Meets on West Coast

For the first time in its 30-year history, the National Society for Crippled Children and Adults, the Easter Seal Society, will hold its annual convention on the West Coast in 1952, it is announced by Lawrence J. Linck, executive director. The convention will be held in San Francisco, October 25 through 30, Mr. Linck said. The Fairmont Hotel has been selected as convention headquarters. Nationally recognized authorities in all professional fields related to work with the crippled will participate in the program. The annual meeting of the Delegate Assembly of the National Society and its 2,000 affiliates in the 48 states, District of Columbia, Alaska, Hawaii and Puerto Rico will be part of the convention activities.

Research Center on Poliomyelitis

The University of Michigan Hospital at Ann Arbor will open a research center for extensive clinical research on poliomyelitis. The center will be sponsored by the university and the National Foundation for Infantile Paralysis. Dr. James Wilson will have over-all supervision of the center.

Rehabilitation Conference

The Second Annual Rehabilitation Conference of the Bay State Society for the Crippled and Handicapped, Inc., will open March 12, 1952, at the Hotel Copley Plaza, Boston, Mass.

Accepted Device

Liebel-Flarsheim Short-Wave Diathermy, Model SW-660 Accepted. — Manufactured by The Liebel-Flarsheim Company, 303 W. Third St., Cincinnati, 2, Ohio, this apparatus generates radio frequency energy at 27.12 megacycles for medical application. A coaxial line oscillator is used for frequency control. The Council on Physical Medicine and Rehabilitation voted to include the device in its accepted list.

Personals

At the Physical Medicine and Rehabilitation Seminar held at the VA Hospital, Brooklyn, New York, on January 18, 1952, the following topics were presented: "Physical Treatment in Low Back Pain" by **Hans Kraus**, M.D.; "Ultrasonics and Its Application in Physical Medicine" by **H. J. Behrend**, M.D., and "Physical Medicine in the Treatment of Peripheral Vascular Diseases" by **Karl Harpuder**, M.D. Dr. **Otto Eisert** acted as Chairman.

The following officers were elected at the December, 1951, meeting of the Cleveland Society of Physical Medicine and Rehabilitation: Dr. **Harry T. Zankel**, President; Dr. **Roswell Lowry**, Vice-President; Dr. **Bert A. Treister**, Secretary-Treasurer. Doctors **Walter M. Solomon** and **Walter J. Zeiter** will serve on the Board of Trustees, along with the officers.

At the December meeting of the New York Society for Circulatory Diseases, Inc., Dr. **Walter S. McClellan** presented the topic, "Groedel as a Balneologist."

Lt. Col. **Raoul C. Psaki** was recently assigned to Letterman Army Hospital, San Francisco, California, as Chief of Physical Medicine Service. Dr. Psaki was former chief resident in physical medicine at Walter Reed Hospital, Washington, D C.

Dr. **Arthur L. Watkins**, Massachusetts General Hospital, Boston 14, Mass., has been elected representative to the Scientific Exhibit, Section on Physical Medicine and Rehabilitation, American Medical Association, Chicago Session, June 9-13, 1952.

Dr. **Charles F. McKhann**, Cleveland, has recently been appointed as acting medical director of the United Cerebral Palsy Association. He states there are between 15,000 and 22,000 babies born each year in the United States with an incapacitating neurological handicap in the form of cerebral palsy alone, or in combination with a convulsive disorder or mental retardation.

Congress on Medical Education and Licensure

The 48th annual meeting will take place on February 10-12, 1952, at the Palmer House, Chicago. Write direct to the hotel for your reservation.

Newly Registered Therapists

December 7, 1951

Anderson, Malcolm Stone, 310 Campbell Ave., Tullahoma, Tenn.

Brautigam, Norman Lee, 603 Royal Dr., Jackson, Mich.

Chaix, Elmone Beatrice, 1656 Malcolm Ave., Los Angeles 24, Cal.

Clements, Jean May, Box 241, Riviera Beach, Fla.

Crabtree, William Roderick, 712 Vance Ave., Paris, Ill.

Crutcher, Mack, Jr., 212 Court St., Louisa, Ky.

Fox, Freda Isabel, R. D. No. 3, Smethport, Pa.

Gabala, John Michael, 48 Main St., Junedale, Pa.

Hill, Mary Alice, 319 N. Curtis Ave., Alhambra, Cal.

Holway, Clyde Robert, 4038 Vineland Ave., Baldwin Park, Cal.

Irwin, Thomas Benjamin, Rt. No. 1, Box 407½, Mira Loma, Cal.

Ishida, Grace Sachiko, 653 E. 165th St., Gardena, Cal.

Johnson, Margaret Mary, 8 Sycamore St., Albany, N. Y.

Kisling, Marilyn Mildred, 11 Deer Creek Woods, St. Louis, Mo.

Kreisle, Margaret Mary, 621 Division St., Evansville 11, Ind.

Mankin, Marion Ellen, 947 N. Orlando Ave., Los Angeles 46, Cal.

Moore, Harriet Mary, 1031 Commodore Dr., Richmond Heights, Mo.

Powderly, Clyde Albert, 107 Cheney St., Jerseyville, Ill.

Schamp, Barbara Ann, % Ralph Schamp, 2935 Lutaway St., Toledo, Ohio.

December 14, 1951

Bradley, Mary M., Vilas, N. C.

Cunningham, Grace Mabel, 77 Hackensack St., East Rutherford, N. J.

Dmytryshyn, Walter, 7440 Oakman Blvd., Dearborn, Mich.

Eatman, Jerome Rex, 3004 Ruffin St., Raleigh, N. C.

Everhard, Susan Felice, Rt. No. 1, New Philadelphia, Ohio.

Flanagan, Eleanor Mae, 828 Bronx River Rd., Bronxville 8, N. Y.

Gilchrist, Roy Allen, 403 W. Broad St., Darlington, S. C.

Holland, Emily Johnson, 107 Windsor Rd., Tenafly, N. J.

Messenger, Betty Jean, Rt. 1, Maidsville, West Va.

Miller, Lois Ann, 2363 Hanawha Blvd., E., Charleston, W. Va.

Pogue, Thomas Molloy, 1917½ S. 7th St., Ironton, Ohio

Sullivan, Mary Jean, 94 Seneca St., Hornell, N. Y.

December 18, 1951

Agresti, Mary Louise, 1581 Jackson St., Aliquippa, Pa.

Blauer, John H., 925 Kirkwood, Iowa City, Ia.

Bouman, Helen Louise, 1340 St. Charles Ave., Lakewood 7, Ohio.

Brunner, George David, 128 Kipling St., Elyria, Ohio.

Buschow, Elizabeth Ann, 904 Florida Ave., Pittsburgh 28, Pa.

Campbell, Shirley Isabelle, 160 Maple Ave., Blairsville, Pa.

Carpenter, Antoinette, 312 S. Fifth St., Geneva, Ill.

Chinn, Thelma, 55 Bridge St., Watsonville, Cal.

Cott, Barbara Emory, 6345 Glenview Pl., Pittsburgh 6, Pa.

Cottom, George Edward, 256 Connellsville St., Uniontown, Pa.

Cousens, George Edwin, 3035 Hamilton Ave., Richmond 3, Cal.

de Leon, Marisa Lusiardo, 3101 Gough St., Apt. 307, San Francisco 23, Cal.

Devlin, Mary Jane, 602 Sherman Ave., Pittsburgh 12, Pa.

Diznoff, Dorothy M., 1117 Chislett St., Pittsburgh 6, Pa.

Dodds, Rosemary Judith, 604 Fifth Ave., S., Moorhead, Minn.

Dorr, Mary Jeanne, 624 N. Linn, Iowa City, Ia.

Duccini, Ermine Raymond, Rt. 2, Box 101, Fair Oaks, Cal.

Dudek, Jean Rose, R. D. No. 1, Brown's Lane, Allison Park, Pa.

Eaton, John Richard, 411 W. 8th Ave., Gary, Indiana.

Fellows, Dale Russell, 614 S. Main, Sioux Falls, S. Dak.

Ferris, Anna Elizabeth, Grand View, Nyack, N. Y.

Fix, Nancy Lee, 1853 E. 93rd St., Cleveland, Ohio.

Galbraith, Margaret J., 296 Westlawn, Iowa City, Iowa.

Gorman, Geraldine M., 2145 Oregon, Berkeley, Cal.

Gossett, Robert L., 127 Fourth St., West, Brewster, Ohio.

Halstead, Daniel P., Jr., 1610 Second Ave., Walnut Creek, Cal.

Hauser, Elna Marion, 38 Clipper St., San Francisco 14, Cal.

Hayden, Ruth Scranton, 63 Imlay St., Hartford 5, Conn.

Hesch, Ann Elizabeth, Falling Rock, West Va.

Hirsch, Otto, 2252 Ashby Ave., Berkeley 5, Cal.

Hislop, Helen Jean, 2806 Parkway Ave., Linden, N. J.

Kasputis, Dorothy Elaine, 1802 8th St., Beaver Falls, Pa.
Kerr, Marian Frances, Box 222, Russell's Point, Ohio.
Kovach, Lorraine, 48 Hale St., San Francisco 24, Cal.
Levendosky, Florence Rosemary, 16 Twining St., Binghamton, N. Y.
Lewis, Selvin Thomas, 5614 Beacon St., Pittsburgh 17, Pa.
Liebermann, Mary Anna, R. D. Box No. 4, Latrobe, Pa.
Lindsey, Carolyn Ann, 1701 Barr Ave., Pittsburgh 5, Pa.
Lynch, Margery, 22 N. Grandview Ave., Pittsburgh 5, Pa.
Martens, Jean A., 9 Philmore Ave., Caledonia, N. Y.
Martz, Mary Gretchen, 15 Lance Dr., Charleston, W. Va.
Mason, Beverly Jane, R. R. No. 3, Galesburg, Ill.
Maul, Robert Glen, Box 217, Thomas, W. Va.
Meyer, LeRoy Donald, Box 455, Ackley, Iowa.
Miller, Deanie Nevada, 725 W. 18th St., Pueblo, Colo.
Miller, Jack Welsh, 312 Reed St., Clearfield, Pa
Morse, Carolyn Frances, 955 Drewry St., N. E., Atlanta, Ga.
Mulroy, Joseph Earl, Box 552, Taft, Cal.
Murer, Niels Peter, 559 Ortega St., San Francisco 22, Cal.
Newton, Virginia Wachter, R. D. No. 1, Evans City, Pa.
Nochta, Robert, 3722 E. Indian School Rd., Phoenix, Ariz.
Oishi, Marion Tamiko, 3024 Blossom St., Oakland 1, Cal.
O'Meara, John Vincent, Hawarden, Iowa.
Pagan, Orfa Nereida, G. Z. A., 30, Puerto Nueno, P. R.
Pancake, Sally Ann, Romney, West Va.
Paustian, Wayne Vernette, Box 435, Gladbrook, Iowa.
Porterfield, Clifford Edward, R. D. No. 1, Butler, Pa.
Raines, Paul A., 142 73rd St., North Bergen, N. J.
Reid, Doris Hayes, 729 N. Martha, Dearborn, Mich.
Reiger, Fatina Fay, 4618 Forbes St., Pittsburgh 13, Pa.
Robertson, Hazel Elizabeth, 1209½ E. Ridgewood St., Orlando, Fla.
Schippers, Ronald LeRoy, 915 Finkbine Park, Iowa City, Iowa.
Simon, William Wassel, Box 211, Vestaburg, Pa.
Smith, Garland Morris, 243 Jarrott Lane, El Cajon, Cal.
Smith, Henrietta, 217 10th St., Huntington, W. Va.
Smith, Shirley Eleanor, 133 Elmore Rd., Pittsburgh 21, Pa.
Steding, Dallan Louis, 228 Reifert St., Pittsburgh 10, Pa.
Steele, Helen Joan, 3325 Meade St., Denver, Colo.
Stevens, Joyce Whistler, 1048 Orchard Rd., Lafayette, Cal.
Strohm, Bernard Robert, 116 Central Park, Iowa City, Iowa.
Takacs, Stephen Joseph, Sabraton, W. Va.
Weaver, Ralph Edward, Jr., 1424 Forsythe St., Pittsburgh 12, Pa.
Wilson, Edith Elizabeth, 1424 Church Ave., Scranton 8, Pa.
Wojciak, Raymond Joseph, 322 Lehigh St., Pittsburgh 32, Pa

30th Annual Session

SCIENTIFIC EXHIBIT SPACE

Requests for applications for scientific exhibit space in connection with the 30th Annual Session to be held at The Roosevelt, New York, New York, August 25, 26, 27, 28, 29, 1952, are being received. Address all communications to the American Congress of Physical Medicine, 30 North Michigan Avenue, Chicago 2.

BOOK REVIEWS

CLIMATE IN EVERYDAY LIFE. By *C. E. P. Brooks,* I.S.O., D.Sc., F. R. Met. Soc. Cloth. Price, $8.75. Pp. 314 with 34 illustrations. Philosophical Library, Inc., 14 East 40th Street, New York 16, 1951.

Initially interested in the deterioration of various materials stored in the tropics, the author has gradually broadened the scope of his work to include the effects of temperate and frigid climates on materials of all sorts, including especially the substance of the human body. This leads directly to those aspects of physical medicine or biophysics dealing with human reactions to temperature, humidity, atmospheric pressure, air movement, and so on. The book is divided into three parts: (1) Living with the Climate, (2) Climate as an Enemy, and (3) The Control of Climate. The last-named section includes a discussion of air conditioning, lighting, and clothing. Especially direct and undeniable are the phenomena discussed in the chapter on "Climatic Accidents," where the author describes the loss of life attending floods, hail, lightning, and windstorms. The discussion of clothing is brief but up to date. The book is well illustrated and indexed, and lacks only specific information on the geography of human disease to make it useful to the practicing physician.

FACTORS REGULATING BLOOD PRESSURE. Transactions of the Fourth Conference, Sponsored by the Josiah Macy Foundation, February 23-24, 1950, New York, N. Y. Edited by *Benjamin W. Zweifach* and *Ephraim Shorr.* Department of Medicine, Cornell University Medical College, New York, N. Y. Fabrikoid. Price, $3.00. Pp. 212 with 39 illustrations and 26 tables. Josiah Macy, Jr., Foundation, 565 Park Avenue, New York 21, 1951.

This volume is a complete record of the transactions of the fourth conference of the Josiah Macy, Jr., Foundation on factors regulating blood pressure. As a nucleus, fifteen scientists were selected by the Chairman, Doctor Harry Goldblatt, and an annual two day meeting is held at periods of five years. This is the fourth meeting of the group. Every effort is made to include representatives from all pertinent disciplines. As a result plans and ideas are often modified, conclusions more clearly specified or placed on a broader perspective, and spontaneous collaboration take place between investigators working in different departments or even in different universities.

Experience in the research field has led to the conviction that one of the greatest needs today is reintegration of science which is now artificially fragmented by the isolation of the several scientific disciplines. It is the aim of the conference to give a clearer reflection of what takes place in the laboratory and what goes on in the minds of investigators.

Members of this conference are all men who are outstanding scientists who have enriched our knowledge of this perplexing problem. Chairman of the Conference was Doctor Harry Goldblatt. Other members are Doctors Ephraim Shorr, Stanley Bradley, Lewis Dexter, William Dock, William Goldring, Keith Grimson, Arthur Grollman, O. M. Helmer, Eugene Landis, Eric Ogden, and Irvine H. Page. Subjects discussed were: anatomical considerations of hypertension; histological changes in liver and kidney of rats made hypertensive by a choline deficient diet; clinical criteria for the diagnosis and classification of hypertension; renal circulatory adjustments in relation to hypertensive disease; relations of endocrine organs to essential hypertension; necrotizing arteritis in dogs produced by a combination of high fat diet and experimental renal insufficiency; comparative study of experimental renal and human essential Hypertension with respect to the participation of the hepatorenal vasoactive factors, V. E. M. and V. D. M.; treatment and prophylaxis of experimental renal hypertension with renin; purification of angiotonin by chromatography and partial separation of renin and sustained pressor principle from kidney and estimation of the renin content of the kidney in normal animals and in different experimental conditions. Each paper is concluded with a verbatim discussion and a list of valuable references. For those physicians who are interested in the subject of hypertension this book will prove invaluable. However, it should be in the hands of all physicians who wish to keep advised of the changing medical horizon.

PHYSICAL BIOCHEMISTRY. By *Henry Bull,* Ph.D., Professor of Chemistry, School of Medicine, Northwestern University. Second Edition. Fabrikoid. Price, $5.75. Pp. 355 with illustrations. John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, 1951.

The author states the purpose of this volume is to bring to the student of the biological sciences a picture of physical chemistry which is meaningful to him. Doctor Bull has used the experimental rather than the theoretical approach. It is most important that medical students acquire a broad training in the basic sciences so they can develop a background which will enable them to integrate to some extent the enormous and diverse material with which they are faced. Without such a background the physician will find it difficult to keep pace with the changing therapeutic disciplines which are continually occurring in the field of medicine during his lifetime.

This second edition of the book has been completely revised — about one-third has been completely rewritten and new material woven into the pattern of the text. The volume is an outgrowth of a series of lectures given to graduate students in biochemistry, physiology, bacteriology, and neurology. The contents include the following chapters: atoms and molecules; energetics; reaction kinetics; ions in solution; electrical conductance; electromotive force cells; acids and bases; oxidation and reduction; electrokinetics; surface activity; biopolymers; osmotic pressure and related properties; viscosity and the flow of liquids; diffusion; the ultracentrifuge; and high polymeric structures. Each chapter is closed with a series of problems and questions and an excellent list of references are given as footnotes.

The excellent text is well presented and the material well organized While it does not bear any direct relationship to physical medicine it will interest the physiatrist engaged or interested in research.

FACIAL PARALYSIS, Being a Treatise on a Clinical Classification of Paralysis of the Facial Nerve. By *J. Parkes Findlay*, M.B., Ch.M., Honorary Assistant Oral Surgeon, Sydney Hospital. Published by the Author and Distributed by Angus & Robertson. Ltd., 89 Castlereagh St., Sydney, Australia, 1950. Cloth. Price, 17s, 6d.

This small monograph of 47 pages is devoted in large part to a description of the anatomy of the facial nerve including blood supply and muscle innervation derived from standard texts. Symptomatology and an adequate description of electrical tests are presented and then the main thesis, that of division of Bell's palsy into three groups: geniculate, neuritic, and vascular occlusion palsies. The first is largely a quotation from Hunt's classical description. The second is primarily infectious in relation to nearby structures. The third group is thought to be due to sudden occlusion of the vaso-nervorum and is characterized by sudden onset of paralysis and acute postauricular pain. The prognosis of the first two groups is said to be good in 80 per cent with little or no treatment, although massage, splinting and electrical stimulation are mentioned. The treatment of the third group is said to be surgical, namely, decompression. No statistics are supplied as to experiences in the various groups. Electrical tests are said to be of doubtful value and immediate operation indicated if pain is present leading to a diagnosis of occlusion of the blood supply. An unconvincing account of the need or value of surgery and of the diagnostic categories is included.

MEDICAL DIAGNOSIS: APPLIED PHYSICAL DIAGNOSIS. Edited by *Roscoe L. Pullen*, M.D., F.A.C.P., Professor of Graduate Medicine, Director of the Division of Graduate Medicine, and Vice Dean of the School of Medicine, Tulane University of Louisiana; Senior Visiting Physician, Charity Hospital of Louisiana at New Orleans; Consultant in Medicine, Veterans Administration Hospital, New Orleans, Louisiana; Consultant to the Surgeon General, Department of the Army, Washington, D. C. Second Edition. Cloth. Price, $12.50. Pp. 1119, with 601 figures, 46 in colors. W. B. Saunders Company, 218 W. Washington Sq., Philadelphia 5, 1950.

Even books on physical diagnosis must be revised in a relatively short time today. With the increasing scope of medicine, the mere description of the physical findings is not sufficient. Thus a book such as this, which integrates the history, the physical examination and the use of various accessory procedures such as x-ray, electrocardiograms and other laboratory findings, is more instructive. The emphasis in this book still remains on the examination of the patient, but by including these other factors, the establishment of a diagnosis is more rational.

The book is divided into chapters in which each section of the body is covered by different authorities. Additional chapters discuss the medical history, examination of the patient, electrocardiographic diagnosis, endocrine survey, the child, the aged, and others.

This new edition brings the material up to date. New chapters include one on blood diseases, diagnosis in the aged, and physical examination of the psychiatric patient.

YOUR BLOOD PRESSURE AND YOU. By *George Halperin*, M.D. Paper Price, $1.00. Pp. 94. Brownlee & Shaw, 1227 Loyola Avenue, Chicago, Ill., 1951.

Another one of these little booklets that tell the poor layman about his troubles. It follows the usual plan of explaining everything so simply, with just enough technical words and explanations thrown in to give the reader a sense of learning the intricacies of medicine. Most of the ideas that cause the greatest anxieties are oversimplified, of necessity; however, to shake the reader's complacency, the customary technique is used in the style, which can be summed up thus — there is nothing to worry about, but. Whether a booklet of less than a hundred pages that can be read in about thirty minutes is worth one dollar might be questioned; but then, what does a dollar buy in this year of 1952.

PHYSICAL MEDICINE ABSTRACTS

Occupational Therapy for Cerebral Palsy. E. M. James.

Brit. J. Phys. Med. 14:149 (July) 1951.

Occupational therapy for cerebral palsy, in recent years, has become a very specialized field of work. Ideally, a child with cerebral palsy should be treated from babyhood by a team of therapists comprising a physical therapist, occupational therapist and, in many cases, also a speech therapist. The entire program of treatment for a cerebral palsied child must be carried out by the whole team of therapists For example, the physical therapist will teach the athetoid basic relaxation while lying, sitting, and later control of standing and walking. The occupational therapist will be the link between physical therapy and every day life; she must carry the arm relaxation a stage farther and use it for arm occupations. The speech therapist will use relaxation to achieve control of speech. For the spastic and ataxic, similar teamwork is necessary as determined by the different principles of treatment. Each individual cerebral palsy child needs to be handled as his handicap demands and this must be done consistently by all who deal with him, including the parents, to whom his particular problem must be explained. Their cooperation by and with the therapists is essential in the over-all aim of treatment if the child is to become capable of taking his place in the world.

Shoulder-Hand Syndrome Following Myocardial Infarction: Treatment by Procaine Block of the Stellate Ganglion. Daniel M. Swan, and John M. McGowan.

J. A. M. A. 146:774 (June 30) 1951.

The shoulder-hand syndrome occurs in approximately 10 to 20 per cent of cases of myocardial infarction. The degree of disability reported has been variable: in some cases it has been described as minor; in other cases it has been extremely severe, leading to serious incapacity and inability of the patient to perform useful work. Formerly, treatment recommended for this condition included physical therapy, roentgen treatments, ganglionectomy and periaterial sympathectomy. A sufficient number of cases of procaine block of the stellate ganglion have been reported in the literature to indicate the beneficial results of this treatment. This paper reports the results of treatment of a series of patients with shoulder-hand syndrome by stellate block with procaine hydrochloride by the anterior approach. This method is considered to be fairly simple and is consistently successful when employed with a reasonable amount of skill. The results have been excellent in every case.

Technique of Ultrasonic Therapy. Albert W. Bauer.

Brit. J. Phys. Med. 14:145 (July) 1951.

It is now well known that ultrasonic energy evokes a variety of biological responses of interest to therapy. Some of the medical applications of ultrasonics reflect the enthusiasm for new methods of treatment rather than clinical discretion or biological understanding. Others are well founded in clinical experience. It should be noted that in the course of the last twelve years a certain technique was developed in the application of ultrasonic energy which, on the whole, has been taken into account in the design of ultrasonic equipment. Nevertheless, many problems are still unsettled. When choosing ultrasonic treatment one must select: (a) the frequency, (b) the type of waves, (c) the intensity, (d) the type of soundhead, (e) the method of application, (f) the duration, and (g) the number of sessions. The main indications for the use of ultrasonic energy are the so-called rheumatic diseases. The ultrasonic energy tends to soothe and restore movement.

Acceleration of Convalescent Care of Poliomyelitis Patients. Charles L. Lowman.

J. A. M. A. 146:1097 (July 21) 1951.

Lowman recommends (1) an over-all plan for the patient through all stages of treatment with evaluation of the physical therapy aspects of care; (2) a thorough evaluation of performance, especially in relation to trunk muscle imbalance and potential deformity factors; (3) early surgical reconstruction when necessary and advisable; (4) an all-around increased effort to conserve patients' and workers' time and personal and institutional funds by increase in the tempo of care of poliomyelitis patients to the highest point commensurate with careful consideration of the needs of each patient.

Tarsal Anomalies and Peroneal Spastic Flatfoot. Frederick S. Webster, and William M. Roberts.

J. A. M. A. 146:1099 (July 21) 1951.

In the treatment of spastic flatfoot the early recognition of tarsal anomaly as the etiological factor in its production is important. The plan of therapy varies somewhat depending upon the anomaly, the type of syndrome, the age of the patient, and the degree of secondary arthritic involvement. Conservative measures are primarily reserved for cases which have only an occasional complaint following trauma and for cases of symptomatic talocalcaneal anomalies in children too young for arthrodesis of the foot. The former cases consist of those with a calcaneonavicular bar exhibiting the second type of syndrome. In these absolute rest of the foot, aided perhaps by whirlpool baths, will cause the acute symptoms of spasm and fixation to subside, but treatment is required over a moderately long period of time and normal flexibility of the foot is never obtained. Consistent support is maintained through the use of firm rubber arch pads. Plaster immobilization under anesthesia is of value since it allows maximal relaxation of the peronei and maintains support of the foot, though usually the same result may be accomplished through rest and whirlpool baths. Manipulation in itself is of no value and actually may be harmful. The rigidity resulting from the anomalies themselves after release of the peroneal spasm does not further improve under anesthesia, and forcing correction is either futile or causes additional injury to the region of congenital abnormality which was the exciting factor originally.

Muscle Relaxants in Low-Back Disorders. Edit.

J. A. M. A. 146:930 (July 7) 1951.

Schlesinger and Stinchfield reported recently on the use of the muscle relaxant mephenesin as a diagnostic and prognostic aid in acute disorders of the lower back. The drug was administered intravenously to 64 hospitalized patients with acute symptoms and signs of herniated intervertebral disk and its effect on the pain and on the results of the straight-leg-raising test was observed. They noted four types of reaction: (1) Abrupt relief of low-back and sciatic pain and striking increase in the range of leg motion; (2) abrupt relief of pain with only slight or moderate increase in range of leg motion; (3) abrupt relief of pain with no increase in motion, and (4) rapid relief of local pain, paradoxical aggravation of radiating pain and decrease or no change in straight-leg-raising ability. The muscle relaxation produced by mephenesin has also been found helpful as an adjunct to traction and in the relief of pain in various low-back syndromes, by the above-mentioned authors and by others, but it appears likely that the drug will have its greatest usefulness in differential diagnosis and prognosis.

Arthrodesis of the Ankle Joint:. A Simple, Efficient Method. Newton C. Mead.

Quart. Bull., Northwestern Univ. M. School 25:248 (Fall) 1951.

Surgical fusion of the ankle joint becomes necessary when injury, paralysis, joint disease, or congenital malformation result in loss of function which cannot be restored through more conservative means. It is indicated for many cases of degenerative arthritis which follow traumatic derangement of this weight-bearing joint. Occasionally comminuted fractures produce such severe disorganization of the joint that arthrodesis may wisely be obtained as promptly as possible without waiting for the inevitable painful function which will follow attempts to achieve a normal joint. Other indications are chronic infections, especially tuberculosis, and instability resulting from the congenital lack of an adequate ankle mortice. The flail ankle sometimes produced by infantile paralysis may require fusion of the ankle joint, as well as subtalar arthrodesis, to produce a stable foot. The method described in this paper achieves stability and rapid healing without the use of free grafts, and is more simple technically than any method previously used. It results in a narrow, attractive looking ankle. Since no free graft is used, the postoperative course is not prolonged by the need for revascularization. So far, no disadvantages have been discovered. Experience with this operation has been limited to ankles with traumatic arthritis and to one case in which subtalar arthrodesis had been previously performed. It would seem to be indicated in all situations in which an intra-articular arthrodesis of the ankle is desired, except severe congenital deformities, in which one of the malleoli may be absent. In these situations a bone graft and metal fixation may be necessary. In cases where primary arthrodesis is elected for severe fractures of the ankle, the technique used will vary with the type of fracture, but it often will turn out to be similar to the operation described in this paper. Mead used the technique successfully in such cases for years before he realized that it was a good method for elective arthrodesis of this joint.

Device for Measurement of Differences in Height of Opposite Sides of Body. H. Wright Seiger.

J. A. M. A. 143:1232 (July 28) 1951.

A device for measurement of differences in height of opposite sides of the body is described in detail. It is simple, accurate and may be made at a cost of a few dollars. Measurement with this device requires only a few seconds. It will give accurately, to one-eighth inch, a record of the comparative length, when the patient is standing erect, or both sides of the body at various levels and more particularly of the lower extremities.

Poliomyelitis: Early Diagnosis and Treatment. Martin H. Seifert.

Quart. Bull., Northwestern Univ. M. School 25:286 (Fall) 1951.

The problem of diagnosis is still a perplexing one, because of the relative rarity of the disease. The most important quality of the physician in the diagnosis of any disease is suspiciousness. In regard to poliomyelitis, when illness occurs, with fever, particularly between July 1 and November 1, you should think of poliomyelitis. If you consider it at all, you will at least do the things that would rule it out. Once the diagnosis of poliomyelitis has been settled, the patient should be taken to the hospital, placed in a poliomyelitis bed with a board under the mattress, a foot board separated from the mattress by blocks, with blanket, sheets and no pillow. Passive motion of the arms and legs should be started four or five times daily from the beginning in any but the most critically ill patient, as this will frequently save weeks of stretching later. As the fever recedes, Kenny packs are ordered, as needed, for sore or tight muscles. When the febrile period is passed and the patient is strong enough to tolerate it, have the physical therapist do a detailed muscle analysis. When this has been completed (it may take several days to do it piece-meal in a severely involved patient), the orthopedist should check the patient and prescribe packs, exercise, hydrotherapy in tub or tank, and whatever else might be necessary for treatment of the disability. The caution to be added here is cooperation between the medical attendant and the orthopedist to make sure that the treatment is not too strenuous for the individual patient. It serves no useful purpose to wear out the patient in the process of rehabilitation. In the treatment of the bulbar case, as in no other patient, teamwork is essential. If the patient is handling his secretions well and breathing adequately, leave him alone, except for careful watching and helpful nursing. Remember, restlessness, uncooperativeness, and combativeness on the part of the patient are not signs of a peculiar personality. They are signs of anoxia. Many times such a patient has become entirely rational and cooperative within a few minutes after the airway was cleared by suction or tracheotomy. There is no disease in which teamwork is so important as in poliomyelitis. The attending physician, the nursing staff, the resident staff, the laryngologist, orthopedist, physical therapist, occupational therapist, and, on occasion, the anesthetist, must all cooperate if success is to be attained.

A Traction Device for Fractures of the Forearm. Walter A. Wichern, and Robert H. Bacon.

J. A. M. A. 146:1233 (July 29) 1951.

A traction device for the reduction of fractures of the forearm is described in detail. The device is capable of applying efficient fixed traction, of known amount, which is adequate for the reduction of almost all Colles type fractures without further manipulation. The design and technique of its use and the results are given.

Vascular Complications in Fractures and Traumatology. Donald S. Miller, and Leo Markin.

Indust. Med. and Surg. 20:323 (July) 1951.

The treatment of these complications is of utmost importance. "Gentleness" should be the keynote in the treatment of any vascular complications in traumatology. It is most important to be "vascular conscious" in order to avoid disastrous end results. A cardiorenal vascular survey, including fundoscopic examinations, is important in the elderly group in order to determine the general arteriosclerotic status. A vascular survey, as indicated above, is extremely important and necessary. Avoidance of trauma to collateral and main blood vessels during surgery, elimination or removal of all tourniquets, casts, bandages, and dressings, avoidance of sudden extension in correction of arthritic or fixed deformities, and avoidance of extensive surgery in the aged are some of the important preventive measures. Heat and cold, applied promiscuously to an avascular extremity, should be avoided. Preliminary sympathectomy or paravertebral block injections, as indicated, should be done. Foot hygiene, bed exercises, small doses of alcohol by mouth, as well as some of the commercial vasodilators and anticoagulants should also be used in the proper cases.

Potassium Deficiency in Bulbar Poliomyelitis. Hyman S. Lans; Irving F. Stein, Jr.; Robert J. Becker; Archibald L. Hoyne, and Karl A. Meyer.

J. A. M. A. 146:1017 (July 14) 1951.

Three patients with bulbar poliomyelitis were found to have a potassium deficiency. Treatment of the existing deficiency with intravenously administered potassium chloride resulted in a marked improvement of their condition. Patients suffering from bulbar poliomyelitis who are unable to eat will develop a potassium deficiency unless adequate potassium intake is provided. Severe, prolonged potassium deficiency can be lethal. This condition when present in patients with bulbar poliomyelitis may be a contributing factor in the high mortality rate. Proper treatment of electrolyte imbalance in these patients is essential and must include adequate potassium therapy. Further studies are indicated concerning the relationship of potassium deficiency to the clinical picture and mortality of poliomyelitis.

Second Attacks of Poliomyelitis: Report of a Case with Autopsy Findings. Archibald L. Hoyne, and Irving Lipton.

J. A. M. A. 146:707 (June 23) 1951.

A second attack of poliomyelitis with fatal termination and autopsy findings is presented. It is probable that this is the only reported authenic second attack with fatal outcome. Moreover, it is the first case recorded with complete pathological examination. On gross and microscopic examination the nervous system exemplified evidence of both recent and past pathology. It has been suggested that second attacks of poliomyelitis are due to an immuniologically different strain against which the patient has no previous immunity.

Dyshidrosis Produced by General and Regional Ultraviolet Radiation in Man. M. L. Thomson.

J. A. M. A. 146:684 (June 16) 1951.

In a hot, wet environment general ultraviolet radiation in moderate erythemal doses produced, in seven persons acclimatized to heat but not to radiation, up to 60 per cent diminution in sweating rate on the second or third day after exposure. After recovery from the disturbance of sweating caused by one exposure to radiation, a second exposure produced a further fall in sweating rate in the same persons. The wavelengths causing the reduction in sweating rate are probably present in natural sunlight.

Cause of Changes in Sweating Rate After Ultraviolet Radiation. M. L. Thomson.

J. A. M. A. 146:684 (June 16) 1951.

The vesicular rash found in many subjects after ultraviolet radiation provided evidence that blockage of sweat gland ducts was at least partly responsible for the diminished sweating that followed the radiation. Occlusion of a proportion of the sweat gland ducts in irradiated skin was confirmed histologically. Blockage of sweat gland ducts, however, appears not to be the sole factor responsible for the decreased sweating. Indirect evidence suggests that the secretion itself is reduced. It is suggested that the reduced secretion is brought about by toxins that have diffused from the injured epidermis. Skin injury produced by allyl isothiocyanate (mustard oil) also caused a fall in sweating rate similar in extent and duration to that produced by ultraviolet radiation. The slight reduction of sweating rate caused by locally applied massive doses of histamine suggested that the above effect of ultraviolet radiation and allyl isothiocyanate was not mediated through the release of a histamine-like substance.

Parkinsonism and Rheumatoid Arthritis. Ralph O. Wallerstein.

Ann. Int. Med. 34:899 (Apr.) 1951.

Eighty years ago Charcot first called attention to the possible relationship between Parkinsonism and rheumatoid arthritis. Since then several investigators have pointed out similarities between the two diseases. In an effort to evaluate critically the relationship between the two diseases, 19 patients with frank clinical paralysis agitans, and 28 patients with far advanced, chronic atrophic arthritis were examined. In most patients with Parkinsonism the onset of illness had been very gradual; weakness and tremor had been the first symptoms. In conducting the examinations. attention was focused primarily on the joints. In the majority of the patients, the appearance of the hands bore a marked resemblance to the hands found in chronic rheumatoid arthritis. There was ulnar deviation of the wrists and fingers, flexion at the metacarpophalangeal joints, extension at the phalangeal joints and adduction of the fingers and thumb; in other words, all muscles innervated by the ulnar nerve seemed overactive. Poverty of motion of trunk and face, with attitude of flexion at elbows and knees, enhanced this resemblance. But whereas in atrophic arthritis there is a true loss of mobility, affecting passive as well as active motion and usually ankylosis and deformity, full range of motion could be obtained in the joints of patients with Parkinsonism after overcoming the muscular rigidity by passively flexing and stretching all the large and small joints of the extremities. The patients suffering from rheumatoid arthritis had a definite story of onset with fever and joint pain. In all patients the disease had progressed to complete crippling, with joint destruction and ankylosis. Only one patient appeared to have both diseases. In view of the number of cases of Parkinsonism (19) and rheumatoid arthritis (28) among a group of 500 patients, this coincidence cannot be considered significant. There appears to be no increased incidence of rheumatoid arthritis among patients suffering from Parkinsonism.

Reconstructive Surgery of the Hand. William L. White.

Pa. M. J. 54:330 (Apr.) 1951.

Today traumatic injuries of the hands constitute a major portion of all injuries. Industrial estimates of hand injuries usually exceed 20 per cent of all reported traumatic lesions. The management of these hand injuries requires a knowledge of plastic surgery, orthopedic surgery, neurosurgery, physical therapy, occupational therapy, and brace making: for reconstructive surgery of the hands must include treatment of the entire part, including all systems that may be involved. In the management of joint difficulties of the hands, the first thoughts often will be directed to physical and occupational therapy and the use of activated splints, utilizing springs or rubber bands. Physical therapy hastens the resolution of the processes of repair, occupational therapy develops useful motion, while active splints gently pull the stiffened useless joints into functional position and supply the movable parts with a gentle force to work against. The rehabilitative features of surgery of the hand are not limited to any particular period, but should be continued throughout the entire management. Greatest emphasis, however, is placed upon the use of occupational therapy and work therapy, after completion of all surgical procedures. The place of physical therapy is limited beyond the point of aiding the recovery from the healing reaction.

Treatment of Acne. Leon Goldman.

Postgrad. Med. 9:526 (June) 1951.

Local cleansing and drying measures are continued now in a more regular fashion. The older individual has the responsibility of carrying out these directions by himself or herself. Regular daily ultraviolet therapy may be had at home. This should be supervised by the parent until the youth gets old enough to do it himself. Ultraviolet therapy should be in doses of suberythema and should be discontinued in the presence of irritation. Efforts should be made to prevent the child from going to sleep under the ultraviolet lamp. In the seborrheic patient, therapy with ultraviolet has a good effect. X-ray therapy is reserved for the older youth, for the nodulocystic phases; this form of treatment should be given only by the experienced specialist, and then only as part of a planned regimen, not as the sole therapeutic measure.

The Orthopedic Management of Arthritis. Paul C. Colonna.

Pa. M. J. 54:443 (May) 1951.

In the early stage of arthritis, many of the joint deformities can be obviated by careful attention to the sleeping position of the patient, by the use of fracture boards under the mattress, and by stressing better body balance in walking. Simply the weight of the bed clothes is a factor in producing an equinus or drooping of the foot in those patients recumbent much of the time. Allowing the patient to relax in bed in a semi-Fowler position may give rise to hip and knee contractures as well as deformities of the spine. If simple conservative measures are neglected in the early phase, very resistant deformities may be developed later. Measures directed toward better body posture and improvement of local circulation in the impaired joint by the various modalities of physical medicine, stressing the loss of excess body weight and the restriction to weight-bearing when the arthritis involves the lower extremities, are all-important. Non-weight-bearing exercises such as swimming and exercises under the control of the physical therapist can usually be recommended. Splints and braces all have their place in the conservative management. Fatigue, exposure to damp atmospheric conditions, mental worry, and emotional strain of one sort or another can definitely aggravate the picture, and in the rehabilitation of these patients, many factors on a psychosomatic basis must be considered. Rehabilitation always is a slow process and the aim in these patients rarely can be to cure the patient, for in most of them certain irreparable damage has been done to the affected joint or joints. However, the patient can be made more comfortable and able to return to a gainful occupation.

Visual and Motor Changes in Patients with Multiple Sclerosis: A Result of Induced Changes in Environmental Temperature. Thomas C. Guthrie.

Arch. Neurol. & Psychiat. 65:437 (Apr.) 1951.

Climate and temperature have been recognized as affecting the incidence of multiple sclerosis. Although sex and race appear not to be important factors in its occurrence, its geographical distribution seems to vary significantly with the distance of an area from the equator. According to one study of the mortality statistics in 14 countries, there is "an inverse and rather striking relationship between reported mortality due to multiple sclerosis and mean annual temperature. The colder the climate, the higher the crude death rates for multiple sclerosis." A definite statistical relationship of multiple sclerosis to seasonal variations in temperature does not seem to exist. In the past, in an attempt by physicians to discover effective therapeutic approaches to multiple sclerosis, patients have been subjected to various forms of heating. On the rationale that the disease may be caused by a virus and that a heat-sensitive organism may be found in the spinal fluid, 12 patients were subjected to immersion in a hot bath at 110 F. for 10 minutes. After 115 baths given to the 12 patients, the condition of four showed improvement; that of six showed no change, and that of two became worse. In a general discussion of therapy with hot baths, to patients with multiple sclerosis, the observation was made that "muscle weakness ordinarily was not favorably influenced." Several attempts have been made to treat multiple sclerosis with electropyrexia. With local diathermy, given over the spinal cord, to 13 patients, 10 showed improvement; one relapsed and was then cured; one became worse, and one had questionable results, but the criteria for improvement are vague, and no control series is reported. In general reference to electropyrexia, the comment has been made that fever may bring out latent neurological abnormalities. In general, while hot baths, diathermy, fever cabinets and pyrexia induced with foreign protein have been tried several times in the treatment of multiple sclerosis, inconclusive results have gradually led to their disrepute as effective agents. Of the changes that seem to appear during heating, the generalized weakness, arm weakness, leg weakness and dysarthria have, in general but not always, been present in the patients with multiple sclerosis before heating. The effect of the hot baths seem mainly to have been one of rendering these dysfunctions more evident.

Radioactive Isotopes and Malignancy. Richard H. Chamberlain.

Pa. M. J. 54:550 (June) 1951.

The emissions of radioactive isotopes have proved to be useful in the diagnosis of certain tumors, notably tumors of thyroid gland origin and brain tumors. At the present time the practical clinical application of radioactive isotopes in the treatment of neoplastic disease is largely limited to selected cases of thyroid carcinoma, polycythemia vera, and certain leukemias by means of radioactive iodine and phosphorus. New applications of radioactive gold and cobalt are being explored. Further advances in the biochemistry of cancer may greatly enhance the therapeutic as well as the diagnostic possibilities in the use of these agents.

An Assessment of Therapy in Parkinson's Disease. Robert S. Schwab, and John S. Prichard.

Arch. Neurol. & Psychiat. 65:489 (Apr.) 1951.

Since 1817, when James Parkinson recognized the entity of paralysis agitans among the heterogeneous collection of tremors and paralyses, the most persistent attempts have been made to treat this disease. Charcot thought some of his patients were benefited by riding on horseback. Consequently, he had constructed a fauteuil trepidant, on which he made his patients sit and shake for stated periods. A pupil of his, Gloreux, was so impressed with this idea that he prescribed for his patients a two hour ride each day on as bumpy a conveyance as was possible. During *the past five years patients with paralysis agitans* were given four types of treatment, as well as combinations of them: physical therapy, psychotherapy, surgical treatment, and drug therapy. The physical therapy consisted of either the routine therapy with massage and passive motion, or intensive progressive resistance exercises of the involved muscles under the direction of Dr. T. L. DeLorme. As concerns the effect of physical therapy of the routine type, namely, referral of the patient to the physical therapy department two or three times a week for massage and passive motion, or having a masseur come to the patient's home two or three times a week for the same treatment, Schwab and Prichard formed the following impression: During the actual massage and passive exercises the patient almost always felt better. He was more relaxed and comfortable. As soon as the patient left the physical therapy department, his symptoms returned, and the benefit of the treatment lasted only an hour or two at the very most. There was no evidence in this type of physical therapy of any true benefit. change in symptoms, improvement in signs or alteration in the progress or state of the disease. The special approach through progressive resistance exercises is a separate project, in which a specific weakness or stiffness in one muscle group, for example, in the left leg, or even both legs, rather than a generalized involvement, is the chief disability. These patients are seen in consultation with Dr. T. L. DeLorme and are taken into this project only if they are willing to come in for two to three hours' treatment, four times a week, for two to three months. The other forms of therapy, usually medication, which the patients have been receiving are kept exactly the same throughout this period of observation. Careful assessment is made each week as to changes in signs and in the patient's ability to perform his usual tasks at home and at work. At the end of the project the treatment is stopped for a period of at least a month to see whether any improvement attained has regressed. In a preliminary group of five patients receiving this type of treatment, three have greatly improved in their strength and muscle function and in the ability to use these muscles in normal activities, such as walking and climbing stairs. There has also been a favorable improvement in mood. However, there is no alteration in the objective signs, such as tremor or rigidity or loss of associated movements. One patient in this group continued for six weeks and then reverted suddenly to the previous level after he had been badly shaken up in an automobile accident. This stress was sufficient to make the period of treatment following the accident (one month) ineffective. The fifth patient showed no improvement in any form, and the treatment was discontinued at the end of a month.

Rheumatoid Spondylitis. S. K. Conner.

Arizona Med. 8:33 (June) 1951.

Rheumatoid spondylitis is a chronic, progressive disease characterized by variable remissions and exacerbations. With each exacerbation there is increased deformity and limitation of motion. Its course may become arrested at any stage of progression, and pain becomes less as ankylosis occurs, whether the patient's spine is straight or kyphosed. There is no known cure for rheumatoid spondylitis, but early, continuous treatment of the right nature will do a great deal to give relief of pain, prevent spinal deformity, and at times shorten the course of the disease. Symptoms often are relieved after complete ankylosis has occurred except for the limitation of motion and certain activities. Orthopedic prevention of deformities is much more effective than is their correction. Much can be done by the orthopedist to relieve strain, spasm, and to prevent loss of height, kyphosis of the spine, and ankylosis of the hips. Proper beds, sleeping habits and proper braces afford much relief. Physical therapy in the form of local heat and gentle massage increases the sense of well being, aids muscle spasm and tone, and prevents somewhat muscular atrophy and contractures. Deep breathing and postural exercises done regularly and untiringly are of the utmost importance. Successful as well as encouraging results in treatment depend on early diagnosis as much as the correct type of therapy.

The Painful Back. A. W. Bagnall.

Canad. M. A. J. 64:107 (Feb.) 1951.

In most patients with painful backs, psychotherapy must be more practical than intellectual. They get better by feeling better. Non-narcotic anodynes and mild sedation provide the medicinal background but the really important measures are physical therapy and life adjustment. X-ray therapy occasionally is effective after the fashion of a long-lasting anodyne — not for any curative effect on the cause. Physical therapy is directed to exercises designed to build up the spinal musculature to protect against the ordinary jars of everyday life and to maintain a useful range of motion. Erector spinae muscle weakness is a common cause of back pain and, in itself, produces a feeling of physical inferiority contributing its full share to the symptom complex. With the cooperation of the patient, simple non-weight-bearing exercises taught by a skilled physical therapist can do wonders to bolster flagging morale and adapt the afflicted person to resume a gainful occupation. Reasons have been given why the clinical and therapeutic approach to the patient with a painful back must be "total" to be successful. An attempt has been made in this discussion to outline some of the mechanisms by which back pain is produced as a result of the strains of living in this highspeed world of today. Two of these pain-producing mechanisms, overactivity of the sympathetic nervous system, and imbalanced function of the pituitary-adrenocortical axis are discussed in more detail.

The Precipitation of Clinical Poliomyelitis by Injections. I. S. Goerke.

Calif. Med. 74:383 (May) 1951.

In records of 1,321 cases of poliomyelitis in the city of Los Angeles in 1948, notation was made as to whether or not the patient had been vaccinated against smallpox or had received an injection of one kind or another in the period preceding the onset of poliomyelitis. In children under 12 years of age, the incidence of poliomyelitis was slightly higher among those who had had recent vaccination or injection than among those who had not, and the incidence of paralysis was slightly greater also. However, the disparities were not considered statistically significant. They were not wide enough to warrant withholding immunization against other serious diseases on the strength of the possibility that in so doing a slight reduction in the incidence of crippling poliomyelitis might be effected.

Safety Factors in the Clinical Use of Radioisotopes. Clinton C. Powell.

M. Ann. District of Columbia 20:471 (Sept.) 1951.

The potential radiation hazards connected with the use of radioisotopes in humans should be carefully evaluated in terms of the quantity, half-life, and type of radiation involved. On the basis of the evaluation, precautions should be taken to minimize the hazard from the patient as a source of external radiation by the use of distance, time, and shielding. Adequate personnel dosimetry is essential. Consideration should be given to the patient as a source of radioactive contamination with particular emphasis on the disposal of the excreta. These considerations should also extend to such related problems as surgical procedures, postmortem examinations, the transportation of cadavers, and the fogging of x-ray films.

Diagnosis and Treatment of Chronic Occlusive Disease of the Peripheral Arteries. Nelson W. Barker.

Journal-Lancet 71:58 (Feb.) 1951.

The diagnosis of chronic occlusive disease of the peripheral arteries is not difficult if the physician has a high threshold of suspicion for its presence when patients have pain, ulceration, gangrene, changes in temperature or discoloration in an extremity. The most important physical sign is impairment of pulsations in the peripheral arteries. Postural color changes are a good rough indication of the degree of ischemia. There are two important chronic occlusive peripheral arterial diseases, thromboangiitis obliterans and arteriosclerosis obliterans, and almost always they can be distinguished clinically. The general principles of treatment can be classified under the broad headings of: efforts to arrest the progress of the disease; procedures to produce dilatation of uninvolved arteries and arterioles; efforts to increase circulation by mechanical means; procedures for direct relief of pain; instruction in prophylaxis against injury of ischemic tissues, and treatment of ulceration and gangrene.

Three types of apparatus have been used to increase the circulation by mechanical means, namely, the pavaex alternating suction and pressure machine, the intermittent venous compression apparatus and the oscillating bed. At best these are only adjuncts to other methods of treatment. The first has been almost abandoned. The second is of doubtful rationale and is being used less and less. The oscillating bed seems to be helpful in some cases of severe ischemia and is still being used in most hospitals where it is available.

Chicago Society of Physical Medicine and Rehabilitation

The regular February, 1952, monthly meeting of the Chicago Society of Physical Medicine and Rehabilitation will be held on Wednesday, February 27, 1952, at the City of Chicago Welfare Convalescent Home, 51st St. and Vincennes Ave., Chicago, 8:00 P. M. Dinner will be served before the meeting at 6:30 P. M. Dr. Arthur A. Rodriquez will present the topic "Rehabilitation Program." Reservations should be made early with the Secretary of the Society, Dr. Milton G. Schmitt, 6970 N. Clark St., Chicago 26.

Contents—Feb. 1952

Volume XXXIII No. 2

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ORIGINAL ARTICLES

Effects of Some Physical Therapies on Blood Flow. Barbara F. Randall, Ph.D.; C. J. Imig, Ph.D., and H. M. Hines, Ph.D. 73
Discussed by Doctors Park and Hines.

Standardization of Technical Training. F. H. Arestad, M.D. 82

Effect of Progressive Resistance Exercise on Muscle Contraction Time. Thomas L. De Lorme, M.D.; Benjamin G. Ferris, M.D., and J. Roswell Gallagher, M.D. 86

Physical Medicine and Rehabilitation for the Handicapped Worker Over Forty. A Retrospect. Frank H. Krusen, M.D. 93

Daily Activity Testing in Physical Therapy and Rehabilitation. Morton Hoberman, M.D.; Erbert F. Cicenia, M.A., R.P.T., and George R. Stephenson, M.A. 99

●

Editorial 109

●

Medical News 112

●

Book Reviews 114

●

Physical Medicine Abstracts 116

●

EDITOR OF THE MONTH

FREDERIC J. KOTTKE, M.D.

Minneapolis, Minn.

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EFFECTS OF SOME PHYSICAL THERAPIES ON BLOOD FLOW [*]

BARBARA F. RANDALL, Ph.D.
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H. M. HINES, Ph.D.

IOWA CITY

Plethysmograph and thermal measurements have yielded much valuable information concerning the effects of various physical therapies on blood flow. These methods for estimating the volume blood flow have an advantage in that they can safely be applied to the human subject but are unsuitable, for the most part, for conditions which require continuous measurements of slow and rapid changes in blood flow in absolute rather than in relative units. In previous reports accounts have been given of the construction and use of an electromagnetic blood flow meter for measuring the volume blood flow through the vessels of laboratory animals.[1] This method, although it possesses a high degree of accuracy, unfortunately cannot be employed in studies on the human subject or in repeated studies on animals.

This study is concerned with the effects of several physical therapies on the volume blood flow through the hind extremities of adult dogs. The physical therapies employed were massage, passive stretching, electrical stimulation and the application of hot foments. Measurements of blood flow were made in the femoral artery of both anesthetized and unanesthetized dogs. The studies were made on normal, denervated and spastic limbs.

Experimental Method

The method for measuring the volume of blood flow through the femoral artery has been described previously.[1-2-3] In the experiments on unanesthetized animals, local infiltration of two per cent procaine hydrochloride was employed to prevent pain resulting from the exposure and cannulation of the artery. Some experiments were carried out under pentobarbital sodium anesthesia. Heparin was used as the anticoagulant in all experiments. Usually a period of from fifteen to thirty minutes was allowed to elapse after cannulation of a vessel for the establishment of steady states of blood flow in the control period.

Denervation was accomplished by severing both the sciatic and femoral nerves seven to fourteen days prior to study. Spasticity in the muscles was produced by a local injection of a standardized dose of tetanus toxin into the popliteal space of one limb.

Massage of the deep effleurage and petrissage types was applied to the hind limb of the dog by a physical therapist. A definite rhythm was established and the movements, primarily in a centripetal direction, followed the

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[*] From the Department of Physiology, State University of Iowa.

[*] This work was aided by a grant from The National Foundation for Infantile Paralysis, Inc.

[*] Read at the Twenty-Ninth Annual Session of the American Congress of Physical Medicine, Denver, September 6, 1951.

[1] Richardson, A. W.; Randall, J. E., and Hines, H. M.: A Newly Developed Electromagnetic Flow Meter, J. Lab. and Clin. Med. 34:1706 (Dec.) 1919.

[2] Feucht, B. L.; Richardson, A. W., and Hines, H. M.: Effect of Hot Foments on Volume of Blood Flow in Extremities of Dogs, Arch. Phys. Med. 30:687 (Nov.) 1949.

[3] Richardson, A. W.; Imig, C. J.; Feucht, B. L., and Hines, H. M.. The Relationship Between Deep Tissue Temperature and Blood Flow During Electromagnetic Irradiation, Arch. Phys. Med. 31:19 (Jan.) 1950.

pattern of the large muscle group in the leg. The massage was applied for a five-minute period. Volume blood flow was recorded before, during and for at least five minutes following the massage.

Three series of experiments were designed to demonstrate the effect of passive stretching upon the volume blood flow in the normal, spastic and denervated hind limbs of unanesthetized dogs. The stretching consisted of taking the gastrocnemius muscle through its full range of motion by flexing the foot upon the leg with the knee fixed in the extended position. Six excursions through the range of motion were used for each experiment. The range of motion was usually severely restricted in the animals with spastic limbs. The volume flow was recorded before, during and following the stretching period until the flow returned to or approached control level. The flows were analyzed at one-half-minute intervals and the average flow for the duration of the change was calculated.

The effect of electrical stimulation of muscle upon volume blood flow through the femoral artery was studied in dogs under anesthesia. Electrical stimuli were applied to the musculature of the leg in one of several ways. The first method used was the application of faradic current to the sciatic nerve using shielded electrodes. A second group had faradic current applied directly to the muscle through needle electrodes. A clinical stimulator furnished damped sinusoidal current oscillating at a rate of forty times per minute. The active muscle electrode was placed in the vicinity of the motor point of the gastrocnemius muscle and the dispersing electrode was held in place on the foot. Forty contractions were elicited per minute in a rhythmic pattern.

In a previous study[2] an investigation was made as to the effects of hot foment applications upon the volume blood flow in the extremities of anesthetized dogs. These studies have been extended and compared with those on unanesthetized animals. Experiments were carried out on normally innervated, denervated and spastic limbs. In addition, studies were made on normally innervated limbs which were treated with butyl aminobenzoate (Butesin^R) applied in the following manner: After the blood flow had leveled to control a three per cent solution of butyl aminobenzoate (Butesin^R) in sesame oil was painted on the shaved skin of the hind limb. After five minutes the excess was wiped off and a second application made. This procedure was repeated three times and at the end of the fifteen-minute period of control flow hot packs were applied. They consisted of a double thickness of munsingwear and were wrung from water at temperature ranging from 70 to 75 degrees C. The pack was then wrapped around the leg over the gastrocnemius muscle, and covered with oil silk and blanketing. A series of three hot packs were applied. The first and second packs were replaced after two minutes and the third was left in place for five minutes so that the total heating time was nine minutes. The temperature of the hot pack was measured by the insertion of a mercury thermometer into the pack. Temperature changes in the subcutaneous tissue were measured by means of an iron-constantan thermocouple needle[4] inserted into the desired position. The potentials were read every minute on a Leeds-Northrup potentiometer. Control values for blood flow were taken for fifteen minutes before the hot packs were applied. After removing the pack, the blood flow was followed until it returned to or approached control values whenever possible. When unanesthetized animals were used, the experiment had to be terminated five minutes after the removal of the third pack because of difficulties encountered in keeping the animals quiet for longer periods of time.

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[4] Tuttle, W. W., and Janney, C. D.: The Construction, Calibration, and Use of Thermocouples for Measuring Body Temperatures, Arch. Phys. Med. 29:416 (July) 1948.

Results

The recordings of blood flow were made at two chart speeds. At fast speed, each vertical line represented 2.5 seconds and at slow speed; time was marked in minute intervals at the bottom of the records.

Chart 1 is a sample record showing the changes in volume blood flow produced during and following the five-minute period of deep stroking and kneading massage. During the massage a slight decrease in the arterial volume blood flow was found. At the end of the period of massage, the flow returned to or increased slightly, but not significantly, above the control flow. Evidence presented indicates that massage of the deep effleurage and petrissage types has very little effect upon the volume blood flow in the femoral artery of dogs. The slight decrease found during the massage was probably related to a compression of the vessels from the massage movements. These results agreed essentially with those found by Wakim, et al.[5] In view of this it seems that the clinical improvement found in conditions for which massage has been shown to be beneficial must be due to some physiologic factor other than an increased blood flow.

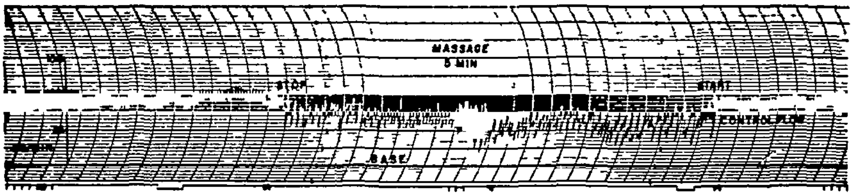

Chart 1. — Record showing effect upon volume blood flow of a five-minute period of deep stroking and kneading massage

A typical blood flow record obtained during and following the stretching of a normal limb can be seen in chart 2. During stretching there was some increase in volume blood flow. Immediately following the stretching the flow was markedly increased, reaching a maximum in about thirty seconds. The per cent changes in volume flow resulting from stretching normal, denervated and spastic limbs were compared graphically (chart 3) and analyzed statistically. Both spastic and normal limbs responded to the stretching with significant increases in the volume blood flow. The spastic limbs showed the greater increase although there was no statistical difference between these and the normals. The duration of the increases in the spastic extremities was three to seven minutes, whereas all the normals had returned to control at the end of three minutes. No significant changes in blood flow occurred when denervated limbs were stretched.

Faradic stimuli at a frequency of sixty per second produced similar effects upon blood flow regardless of whether they were applied to the nerve or directly to the muscle (charts 4 and 5). Immediately upon contraction the volume blood flow in the femoral artery was diminished and remained substantially below control until the stimulus was removed. At this time the flow was markedly increased above the resting level and only gradually returned to control levels. When muscle was activated by a clinical stimula-

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[5] Wakim, K. G.; Martin, G. M.; Terrier, J. C.; Elkins, E. C., and Krusen, F. H.: The Effects of Massage on the Circulation in Normal and Paralyzed Extremities, Arch. Phys. Med. 30:135 (March) 1949.

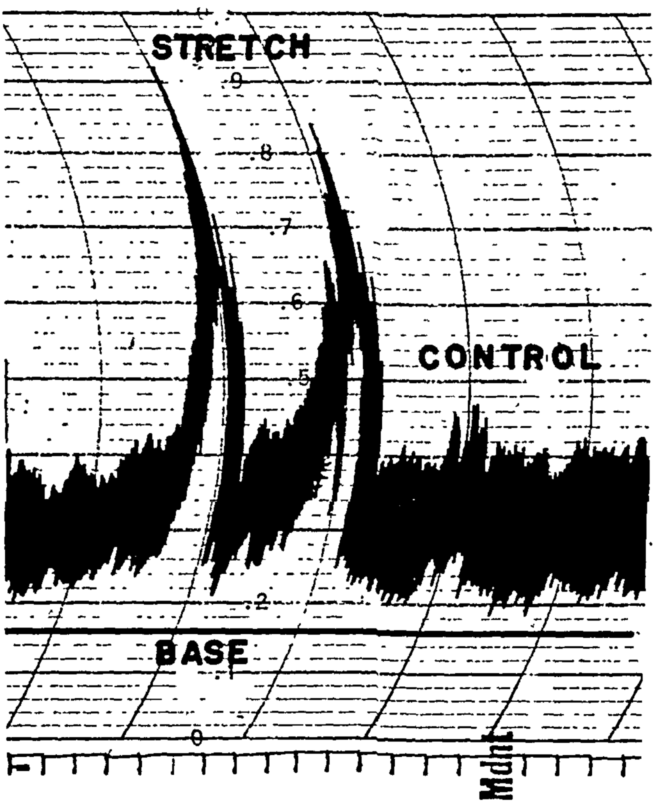

Chart 2. — Record showing changes in blood flow during and following passive stretching of a normal extremity.

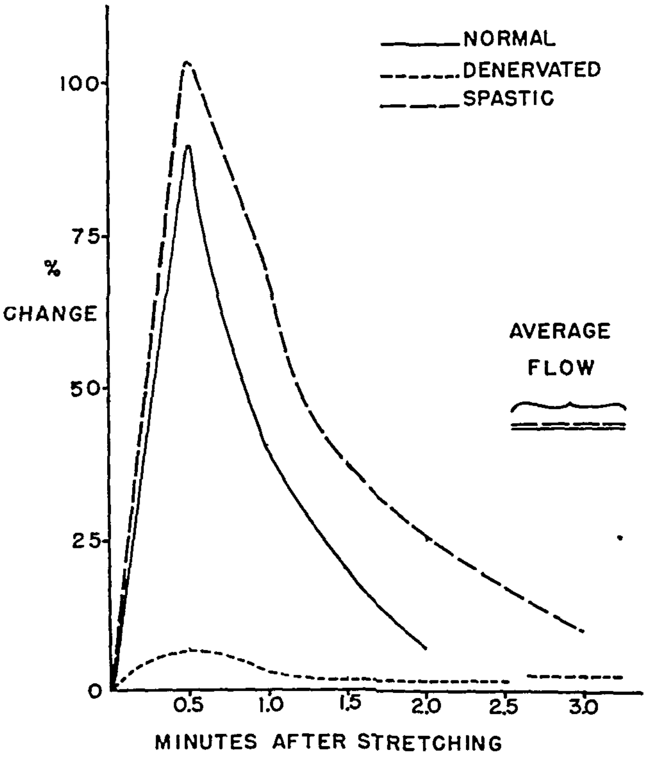

Chart 3. — Effect of passive stretching upon volume blood flow in the limb of dogs under various experimental conditions. Control flows were 62 cc./min. in normals, 56 cc./min. in spastic, and 49 cc./min. in denervated limbs.

tor which delivered stimuli in a rhythmic pattern at a frequency of forty per second there occurred a diminution of flow during contraction followed by augmentation during relaxation. After the stimulation was discontinued the flow gradually returned to the pre-stimulation level (chart 6).

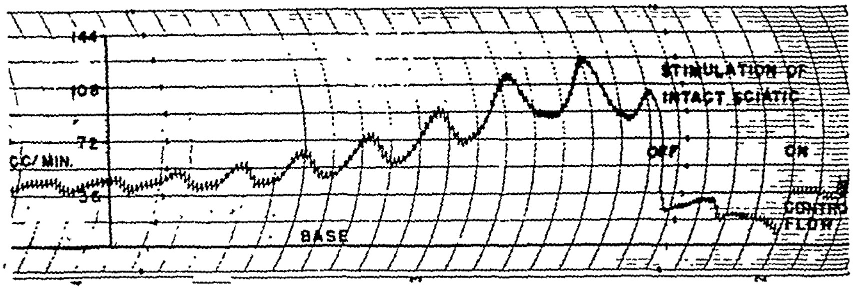

Chart 4. — Record showing changes in volume blood flow during and following indirect muscle stimulation through the nerve using faradic current and shielded electrodes.

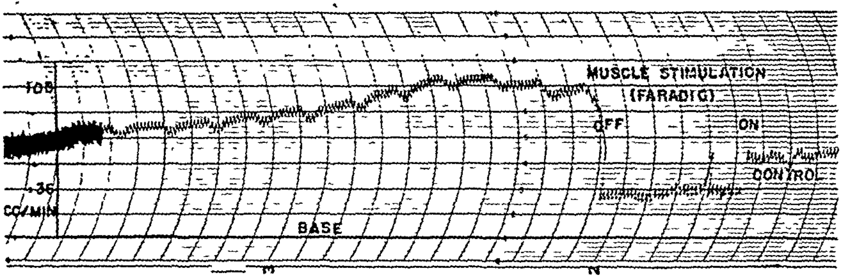

Chart 5. — Record showing changes in volume blood flow during and following direct muscle stimulation using faradic current and needle electrodes.

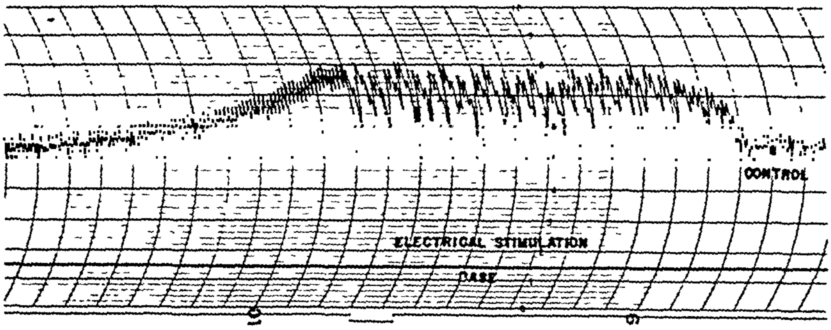

Chart 6. — Record showing changes in volume blood flow during and following rhythmic muscle stimulation using sinusoidal current pulsating at a rate of forty times per minute.

The results of the experiments in which a series of three consecutive hot packs were applied to the normally innervated, Butesin ® treated and denervated limbs of anesthetized and of unanesthetized animals together with their statistical analysis are presented in table 1. In the experiments on normally innervated limbs of animals under anesthesia the volume blood flow increased gradually from the time the first hot pack was applied, the increase becoming significant at the end of three minutes. The maximum flow was attained between two and five minutes after the third pack had been removed. Fifteen minutes after packing, the increases in blood flow were no longer significant although in some animals the flow did not return to control level for as long as forty minutes. The maximum average subcutaneous temperature increase was 8.7 degrees C., attained during the fifth minute of heating (table 2). After this the temperature gradually decreased, although the blood flow continued to increase for some time. The normally innervated limbs of unanesthetized animals showed no significant increases in blood flow during the packing. In the fifth minute following the removal of the third pack a significant increase in blood flow was observed. The average maximum increase in subcutaneous temperature was 5.5 degrees C. and occurred during the seventh minute of packing.

TABLE 1. — *Summary of Changes in Blood Flow During and Following Hot Packs.*

		— Per Cent Change in Flow —								
	Control	Minutes During Packing				Minutes Following Packing				
	cc./Min.	3	5	7	9	1	2	5	10	15
					A. Normally Innervated					
Anesthetized —										
Mean	43	+30	+41	+54	+60	+70	+73	+72	+48	+35
S. D.		22	36	27	46	46	59	61	47	41
t		3.6	3.1	5.2	3.5	4.0	3.3	3.1	2.8	2.1
Level of sig.		2	3	1	2	1	2	3	4	10
Unanesthetized —										
Mean	63	+3	+7	+3	+6	+9	+14	+18	....	....
S. D.		8	14	18	18	18	19	17	....	....
t		1.0	1.3	0.4	0.9	1.2	1.8	2.8	....	....
Level of sig.		40	20	80	50	30	20	4	....	....
					B. Butesin-Treated					
Anesthetized —										
Mean	36	—2	—3	+3	0	+4	+12	+17	+5	....
S. D.		15	17	22	22	26	24	28	34	....
t		0.3	0.5	0.3	0.0	0.4	1.4	1.6	0.4	....
Level of sig.		80	70	80	100	70	20	20	70	....
Unanesthetized —										
Mean	47	—7	—16	—11	—12	—12	—8	+3	....	....
S. D.		15	15	15	19	19	19	21	....	....
t		1.2	2.6	1.9	1.6	1.7	1.1	0.3	....	....
Level of sig.		30	5	10	20	20	40	80	....	....
					C. Denervated					
Anesthetized —										
Mean	32	+2	0	+16	+27	+34	+42	+45	+48	+44
S. D.		12	17	22	35	24	21	14	22	37
t		0.4	0.0	1.7	1.9	3.5	5.0	7.7	5.2	2.8
Level of sig		80	100	20	20	2	1	0.1	1	4
Unanesthetized —										
Mean	44	0	+1	+6	+14	+21	+37	+40	....	....
S. D.		4	4	7	10	15	23	23	....	....
t		0.0	0.6	2.3	3.8	3.9	4.5	4.8	....	....
Level of sig.		100	60	10	1	1	1	0.1	....	....

The volume blood flow in the limbs to which Butesin^R had been applied showed no consistent or significant increase either during or following the application of hot foments. This was true for the experiments on both unanesthetized and anesthetized animals. The thermal pattern of subcutaneous temperature changes in Butesin^R treated limbs was not significantly different from that found in untreated limbs.

The response of volume blood flow in the denervated limbs to the application of hot foments was similar in anesthetized and unanesthetized animals. Both showed significant increases in volume blood flow at the end of the packing period. No difference was found between these two groups at any time during or following packing. The average increase in blood flow was greater in normally innervated than in denervated limbs of anesthetized animals. There was no significant difference in the blood flow changes due to the application of hot foments in the normally innervated limbs as compared with that of the denervated limbs of unanesthetized animals.

It was difficult to evaluate the effects of the application of hot foments upon the volume blood flow in spastic limbs. During the nine minutes of packing the animals were extremely restless, so that artifacts from movements of the limb were introduced. The first minute after the removal of the final pack there was a ten per cent increase in volume blood flow over the control, a value which was significant. However, this may have been due, at least in part, to the after effects of augmented muscular tone and contraction. The fact that general anesthesia abolished spasticity prevented the carrying out of experiments on anesthetized animals.

TABLE 2. — *Increases in Subcutaneous Temperature During and Following Hot Packs.*

	Control	Minutes During Packing					Minutes Following Packing			
	°C	1 °C	3 °C	5 °C	7 °C	9 °C	1 °C	2 °C	5 °C	10 °C
		A. Normally Innervated								
Anesthetized —										
Mean	35.8	5.2	7.6	8.7	7.9	7.1	3.3	2.3	1.0	1.0
S. D.		2.3	3.1	2.8	2.3	1.4	1.7	0.8	1.3	1.2
t		5.4	5.9	7.9	8.1	19.7	4.7	6.6	2.0	2.1
Level of sig.		1.0	1.0	0.1	0.1	0.1	1.0	1.0	20.0	20.0
Unanesthetized —										
Mean	38.2	2.4	4.1	5.4	5.5	5.0	1.8	0.9	0.8	0.4
S. D.		0.7	0.8	1.4	1.5	1.9	1.0	0.9	0.9	0.8
t		9.6	14.6	11.0	10.0	7.4	5.1	0.9	2.5	0.5
Level of sig.		0.1	0.1	0.1	0.1	0.1	1.0	40.0	5.0	80.0
		B. Butesin-Treated								
Anesthetized —										
Mean	36.2	3.2	6.5	7.7	7.1	6.3	3.3	1.6	0.7	0.5
S. D.		2.1	3.6	3.3	2.5	2.7	1.8	1.6	1.6	1.6
t		4.2	3.6	4.5	4.5	4.9	3.6	3.1	0.9	0.6
Level of sig.		3.0	4.0	3.0	3.0	2.0	4.0	10.0	50.0	60.0
Unanesthetized —										
Mean	38.3	3.3	4.7	5.7	4.6	4.5	1.6	1.1	1.2	1.1
S. D.		1.3	1.1	1.5	1.7	1.6	1.0	1.0	0.9	1.2
t		7.5	10.9	11.0	7.9	7.9	13.3	4.0	2.6	2.0
Level of sig.		0.1	0.1	0.1	0.1	0.1	0.1	1.0	4.0	10.0
		C. Denervated								
Anesthetized —										
Mean	36.9	4.2	7.3	7.9	7.2	5.6	1.9	0.8	0.6	0.9
S. D.		2.5	4.5	2.7	1.9	1.1	1.3	1.1	1.1	1.1
t		3.5	3.3	5.6	7.7	9.8	2.7	1.3	1.1	1.4
Level of sig.		5.0	5.0	2.0	1.0	0.1	10.0	30.0	40.0	30.0

Comment

Caution must be exercised in interpreting the significances of changes in the volume flow through the femoral artery. The greater part but by no means all of the blood flow traverses the muscular structures of the limb. It is entirely possible that small but significant changes might occur, due to alterations in the flow through the skin without concomitant changes in the deeper structures. The method employed yields accurate information concerning the total over-all flow and its changes but offers no information concerning its differential distribution between the several tissues supplied by a vessel.

The finding that passive stretching was effective for increasing the blood flow through normally innervated limbs but not through denervated limbs suggests that peripheral dilatation may result from the increased metabolism associated with exaggerated myotatic reflexes rather than from the physical effects of stretching per se. In this connection, it is pertinent to point out that massage techniques short of those involving some degree of stretching have been found to be ineffective measures for increasing blood flow.

In a previous study[3] it was found that the application of electromagnetic waves to a limb resulted in an increased blood flow only providing a certain critical temperature rise occurred in the muscles. Under the condition of our experiments deep tissue temperatures were seldom found to equal or excel this level. The observation that the application of hot packs caused an increase in blood flow in the limbs of anesthetized but not in the limbs of unanesthetized animals requires comment. The average control temperature in the subcutaneous tissue in anesthetized animals was 35.8 degrees C. and the average maximum temperature reached was 44.5 degrees C., or an increase of 8.7 degrees C. In the unanesthetized group the average control was 38.2 degrees C. and the maximum temperature reached averaged 43.7 degrees C., an increase of 5.5 degrees C. It may be assumed that a greater degree of initial vasoconstriction existed in the former than in the latter. The reaction to the application of hot foments is in part due to the direct effects of heat on the smooth muscle of blood vessels and in part due to reflex effects. The application of hot foments may serve as a noxious stimulus, eliciting a protective vasoconstrictor reflex. It is logical to assume that anesthesia may unequally affect the protective and heat-dissipating reflexes.

It is quite clear from numerous studies that it is possible to increase the blood flow through tissues by such measures as the application of heat, exercise, stretching and electrical stimulation. It is also apparent that the procedures effective for increasing blood flow increase the level of metabolic activity in the affected tissue. For instance, it has been found that a rise of 10 degrees C. serves to approximately double the rate of metabolism in tissue and that the oxygen requirements of muscle may increase several fold during exercise. Is the augmented blood flow resulting from the use of these physical therapies sufficient to meet the additional metabolic requirements imposed upon tissue by the therapeutic agents? It is quite possible that in many instances they may serve to aggravate rather than to improve the effective circulatory condition of tissue. Only when the net effects of blood flow changes upon oxygen and carbon dioxide tensions and glucose concentration in tissue have been determined will it be possible to evaluate the efficacy of such physical therapies.

Conclusions

The following conclusions are drawn as to the effects of several physical therapy measures upon the volume blood flow through the femoral artery of dogs:

1. Massage proved to be an inffective measure for increasing blood flow.
2. Passive stretching caused a significant increase in blood flow in normally innervated and spastic but not in denervated limbs.
3. Electrical stimulation of muscle results in an over-all increase in

blood flow. The flow was diminished during tetanic stimulation but increased during the post-stimulation period.

4. The consecutive application of three hot packs to normally innervated limbs of anesthetized animals resulted in an increased blood flow. The increase in flow was not observed when the hot packs were applied to limbs treated with Butesin^R. The increase in flow was greater in normally innervated than in denervated limbs. The hot foment treatments caused no significant increases in femoral arterial blood flow in normally innervated limbs of unanesthetized animals. The flow was increased significantly in denervated limbs of unanesthetized dogs.

5. The question is discussed as to whether the increases in blood flow were able fully to compensate for the augmented metabolism resulting from increase in temperature and muscular activity.

Discussion

Dr. Herbert W. Park (Fishersville, Va.): I think we have heard a very interesting and timely paper concerning the various methods for increasing peripheral blood flow in physiological conditions and compared analysis of the findings. Since impairment of blood flow is one of the significant disorders we have to deal with in our practice of physical medicine, we should consider the results reported very carefully. As Dr. Hines indicated, in various surgical and drug techniques for increasing blood flow, there are certain untoward side effects and shortcomings which either limit their use or make them unfeasible for treatment. In order to apply adequately the information given, we as physicians must of necessity make proper selection of various methods of treatment on the basis of the condition being treated, with full knowledge of the action of the agents being employed. We would like to ask Dr. Hines some questions. 1. Can he answer the perennial question concerning methods of measuring under experimental conditions where only a sampling of blood flow can be done; in other words, has he any information concerning deep circulation as compared with the superficial? 2. From a clinical standpoint quite often we find that although certain results are obtained from animal experiments, their transfer to humans is not possible; we would like to know how well he feels his results can be applied to human physiological conditions. 3. From the physiological standpoint I would like to know his opinion as to which agents are most effective, taking into consideration the various side reactions and metabolic effect. 4. I would like to know if he has done any work in measuring blood flow in the denervated muscle, using medical stimulation. I think this work is very important as far as paraplegics are concerned; I see a great number of them and I know that quite a few in this group do, too. It would be interesting to have a little information regarding the effect of artificial stimulation of blood flow in denervated muscles.

Dr. Hines (closing): It is quite evident that the factors which affect the flow of lymph in the extremities are not necessarily the same for skin and for deep tissues. In some unpublished studies, we have shown that heat causes the usual responses in blood flow when the skin of the animal was removed and replaced with a paraffin coating. However, this is not true in all cases. Whether or not these same findings occur in humans is a matter of conjecture. We applied the same dosages and modes of administration to animals as have been recommended for human subjects. We have not as yet completed any work on denervated muscle.

* * *

STANDARDIZATION OF TECHNICAL TRAINING *

F. H. ARESTAD, M.D.

Associate Secretary, Council on Medical Education and Hospitals,
American Medical Association
CHICAGO

In June, 1933, a resolution was presented to the House of Delegates of the American Medical Association requesting that plans be made for the establishment of standards, ratings and inspections of schools of occupational therapy. On recommendation of the Board of Trustees this resolution was referred to the Council on Physical Therapy (now the Council on Physical Medicine and Rehabilitation) and the Council on Medical Education and Hospitals for consideration and investigation. Under the direction of the Council on Medical Education and Hospitals 13 schools were visited in 1933-34 prior to the establishment of standards in cooperation with the American Occupational Therapy Association and the Council on Physical Therapy. These essentials were adopted by the House of Delegates in June, 1935, to be effective not later than January 1, 1939. The first list, published in 1938, contained the names of 5 approved schools in the United States, a number subsequently increased to 24.

Inspection and Standardization

A year after the introduction of the resolution on occupational therapy, the House of Delegates received a similar request in relation to the standardization and inspection of physical therapy schools. In this connection, the Board of Trustees reported to the House in 1934 that "The Council on Medical Education and Hospitals in cooperation with the Council on Physical Therapy is formulating essentials for physical therapy and occupational therapy schools." Within the next two years the Council on Medical Education and Hospitals completed a survey of 34 physical therapy schools and in August , 1936, published a list of 13 schools approved in accordance with standards adopted by the House of Delegates in May of the same year. These essentials were prepared by the Council on Medical Education and Hospitals in collaboration with the Council on Physical Therapy, the American Congress of Physical Therapy (now the American Congress of Physical Medicine) and the American Physiotherapy Association (now designated as the American Physical Therapy Association). Subsequent expansion of training courses in this field has increased the number of schools to 31.

The Council on Medical Education and Hospitals was also requested by the House of Delegates to undertake the standardization and approval of schools for laboratory technicians, schools for medical record librarians and schools for x-ray technicians. The initial list in medical technology contained the names of 96 approved schools, now expanded to 475. Standards were adopted in the medical record field in 1943, at which time a list of 10 approved schools was established; the present total is 19. In x-ray technique the Council's standards were formulated in 1944 and the following year a list of 112 approved schools was published; this has since increased to 292. In these fields, as in occupational therapy and physical therapy, the Council on Medical Education and Hospitals has received excellent cooperation from

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* Read at the Twenty-Ninth Annual Session of the American Congress of Physical Medicine, Denver, Colorado, Sept. 4, 1951.

the allied medical and technical organizations. In medical technology the formulation of standards and the evaluation of individual schools have been accomplished in collaboration with the American Society of Clinical Pathologists, its Board of Registry and the Board of Schools of Medical Technology, which is currently cooperating in a survey of the approved laboratory schools. The x-ray field is represented by the American College of Radiology, the American Society of X-Ray Technicians and the American Registry of X-Ray Technicians. At present the American College of Radiology is cooperating with the Council in a comprehensive survey of all approved x-ray schools in which the inspection of individual training programs is carried out by the regional councilors of the College. In the training of record personnel, the American Association of Medical Record Librarians participates actively in the formulation of standards and in the evaluation of individual schools.

Under present standards of the Council approved medical schools may conduct acceptable courses in any or all of the technical fields; accredited colleges and universities may be approved in occupational therapy, physical therapy and medical record library science, while individual hospitals may receive approval in all fields except occupational therapy. Certain variations exist, however, in that approved hospitals are specified in physical therapy, (registered) hospitals in relation to medical technology, (registered) general hospitals in x-ray technique and both internship and residency approval when hospital record training is involved. State health laboratories affiliated with hospitals and x-ray departments affiliated with general hospitals are likewise eligible for approval in their respective areas.

Problems of Shortages in Facilities and Personnel

All of the technical fields are at the present time facing a serious problem in the continuing shortage of trained personnel. The approved occupational therapy schools reported 377 graduates last year, physical therapy 490, medical technology 2,011, x-ray technique 923 and the medical record field 83, all far short of the estimated requirements. In seeking the cause of these shortages many factors have been cited, such as the need for additional schools and further intensification of recruitment, the increasing competition with other fields, cost of education, inadequate economic returns, conditions of employment, attrition factors, lack of educational opportunities for male students in some areas, increasing entrance requirements, longer periods of training and the growing apprehension that in some fields the existing standards are already exceeding the bounds of practicability.

In physical therapy, a student is eligible for admission who has graduated from an accredited school of nursing or physical education or has completed two years of accredited college including satisfactory courses in biological and physical sciences. It should be noted, however, that only 7 of the 31 approved schools admit two year applicants, all others requiring three or four years of college except in the case of high school graduates entering a regular degree course or students accepted from schools of nursing or physical education. While the minimum requirement is 36 weeks, none of the approved civilian schools gives less than 12 months of training. Ten, not counting degree courses, offer more than 12 months and in 5 where two year applicants are accepted the training is of two years' duration. From this brief analysis it is apparent that physical therapy is now generally seeking a college level either through the establishment of three years prerequisite education or in the development of a full four year degree course as now maintained in 11 schools.

The educational plan in occupational therapy follows the college pattern. In this field 21 of the 24 approved schools admit high school graduates for courses mainly of 5 years' duration. In addition, certificate courses are offered in 12 schools for degree students, who in practically all instances are given 18 months of training. Three schools admit two year applicants for a minimum of 27 months, while two accept one year college students with a required training period of four years. It follows, therefore, that training in occupational therapy is seldom completed until the student has been out of high school at least 5 years. This long period of training has been regarded in some quarters as a significant factor in the continuing shortage of occupational therapy personnel which has now reached a critical state. In seeking a solution to this problem it has been suggested that consideration be given to the establishment of hospital schools in occupational therapy with a clearer separation of those subjects that might profitably be shifted to a prerequisite level. At present the minimum college requirement is one year; the length of training is 100 weeks, including 39 of theoretical instruction, 25 of technical training and 36 of hospital practice.

In medical technology, where the minimum length of training is 12 months, the entrance requirements are listed at two years of accredited college including 12 semester hours of biology, 6 semester hours of inorganic chemistry and 3 semester hours of quantitative analysis, organic chemistry or biochemistry. The medical record field requires proficiency in typing and shorthand, also 2 years of accredited college or graduation from an accredited school of nursing. The minimum program is 50 weeks. Here it should be noted that college prerequisites are not included in relation to x-ray schools. In this field, admission requirements are based on the completion of four years of high school or graduation from an accredited school of nursing. The length of training is 12 months.

Continuing efforts are being made to increase the educational opportunities for technical personnel. The expansion of x-ray and laboratory schools has been particularly impressive, but progress has also been made in the other fields. The American Occupational Therapy Association and the American Physical Therapy Association, long active in the recruitment of students, have also worked diligently to help foster the establishment of new schools. In support of this program the Council on Physical Medicine and Rehabilitation recommended in December, 1950, that the Council on Medical Education and Hospitals encourage the development of recognized courses in physical therapy and occupational therapy in the teaching hospitals affiliated with medical schools. Acting on this request, the Council on Medical Education and Hospitals addressed a letter to each medical school calling attention to the need of further facilities for the training of physical therapists and occupational therapists. The subsequent replies have been encouraging; 17 medical schools, aside from the 18 already engaged in physical therapy training, have expressed their interest in the development of suitable programs. In occupational therapy, where 11 medical schools are already participating in technical training, there is indication that 13 additional medical colleges may wish to organize similar courses.

Necessity of Further Planning

Medicine's role in the standardization and production of technical personnel is also clearly evident in the interest and active cooperation displayed by allied medical organizations such as your Congress of Physical

Medicine and the Advisory Committee on Education. Many of these activities and responsibilities are likewise shared by individual physicians, particularly those who are directly associated with the training of medical and technical personnel. The physiatrist in his relation to individual schools has not only the opportunity of leadership and active participation in teaching, but also the added responsibility associated with the organization of educational programs. He should, therefore, be directly concerned in curriculum planning, length of training, entrance requirements and other factors important in the procurement and training of technical personnel. In the broader field of medical education his services are likewise essential for the training of young physicians required to meet the expanding needs in physical medicine.

In the fields of physical therapy and occupational therapy much has been accomplished — yet there are many problems still pressing for early consideration. Included in these is need for additional information on the available supply of technical personnel so that more accurate knowledge may be at hand in considering shortages, recruitment, and further expansion of training. Based on this knowledge, effective planning may be instituted to alleviate existing shortages and insure a more adequate supply of technical personnel in relation to future needs. Consideration must also be given to the mounting requirements imposed by individual schools or by policies developed within the technical fields. If such requirements become excessive or if it is found that an adequate supply of technical personnel cannot be produced under present methods and facilities, it may become necessary to modify the existing pattern or depend in increasing degree on the development of subsidiary groups of junior technicians. Continued efforts should be made, however, to increase the opportunities for training, including the possible development of hospital schools in occupational therapy to help overcome the critical shortage in this field. In this connection, it is urged that closer liaisons be established between the technical organizations and the corresponding medical groups so that in a full spirit of understanding the problems of the future may be worked out in the best interest of the public welfare.

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EFFECT OF PROGRESSIVE RESISTANCE EXERCISE ON MUSCLE CONTRACTION TIME [*]

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The rapid clinical development of therapeutic applications of Progressive Resistance Exercise[1-2-3] has far outstripped studies of the physiological responses to them. Basic knowledge of the physiological effects of Progressive Resistance Exercise must be obtained so that questions such as its effect upon muscle bulk, speed of muscle contraction, etc., can be answered. Research by several investigators[3-4] has already begun to add to our understanding of these matters. This preliminary report discusses an exploratory effort to evaluate the influence of Progressive Resistance Exercise on muscle contraction time, and describes the method and apparatus used and some of the difficulties encountered in studies of this nature.

The question as to whether Progressive Resistance Exercise, when used according to clinical practice, produces lengthening of contraction time is of significance to athletes, typists, dancers and others whose efficient performance is dependent upon rapid movement. It is also of interest to trainers and to coaches of athletes in connection with such beliefs as that heavy exercise "slows down," "throws timing off," and makes athletes "muscle bound." Following intensive Progressive Resistance Exercise muscle fibers do hypertrophy, and it is conceivable that concomitant changes may occur in the muscles' viscosity which would alter the contraction time.

Method

Two joint actions, elbow flexion and knee extension, were studied. These were selected because they satisfactorily lend themselves to both the techniques of Progressive Resistance Exercise and to contraction time testing. Ten adolescent boys were chosen for study: five served as controls, five acted as exercise subjects. The control group received no Progressive Resistance Exercise, but its members were tested in the same manner and at the same time intervals as the exercise group. The exercise group was given Progressive Resistance Exercise four times weekly: an intervening school vacation period reduced their average number of workouts to about forty for the four months' experimental period.

The apparatus for testing elbow flexion consisted of a special chair in which the subject sat with the right upper arm supported along the posterior portion by a board (figures 1a and 1b). The ipsilateral shoulder was strapped to the back of the chair so that there would be no shoulder or trunk movement on biceps contraction. The forearm was in partial extension, with the

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ulnar aspect of the closed fist pressing a small button which operated the switch to the electric timer. The circuit of the electric timer was broken by pressure on this button so that the action of the timer was suspended until the test was ready to be performed. From this starting position the arm was flexed with as much speed as possible; and instantaneously with the initiation of elbow flexion, pressure was released from the button, making the circuit and starting the clock. No starting signals were employed, since measurement of reaction time was not the purpose of the study. The subject initiated the contraction at will. As the arm progressed upward it struck a rod, breaking the circuit and stopping the clock. Thus the time interval required to complete the arc of motion was measured.

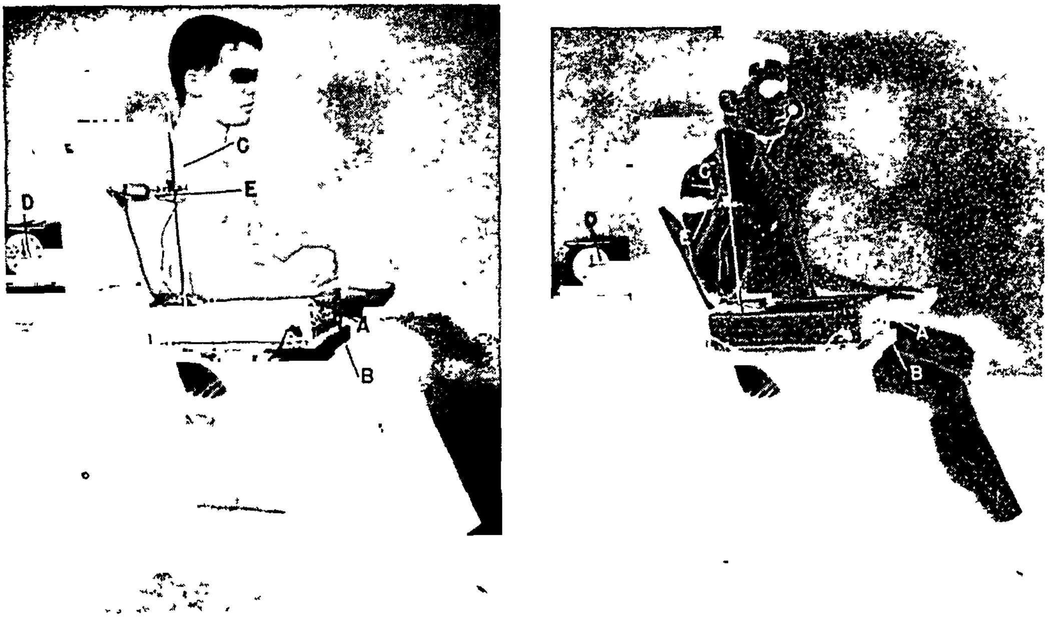

Fig. 1a. Fig. 1b.

Fig. 1a and 1b. — A — Switch for initiating recording by electric timer. Timer starts when hand removed from this switch. B — Pilot light which turns on when contact is made with switch A. C — Bar which controls switch for stopping timer. When bar is struck by hand, timer stops. D — Electric timer. E — Strap for keeping arm fixed to chair in constant position.

The timer used was an electric clock calibrated in and accurate to within 1/100ths of a second. Another feature of this timer is the DC clutch incorporated within it, making possible instantaneous responses to makes and breaks in the circuit.

To measure the speed of quadriceps contraction time a similar apparatus was constructed so that the patient sat on a table with a strap placed over the upper leg to prevent upward motion of the thigh itself (figures 2a and 2b). The body was supported by the hands extended posteriorly, with the hips in semiflexion of about a sixty-degree angle with this body. The heel was pressed firmly against a button which disengaged the electrical circuit. Then the foot was brought up sharply by contraction of the quidriceps alone. Another rod, similar to the one used in the arm procedure, was struck, the circuit broken, and the time interval measured with the same electrical timer in 1/100ths of a second.

A series of preliminary trials (consisting of approximately ten successive contractions) was performed on several days by each of the ten subjects. During this two-week preliminary period each subject's contraction time became more constant. However, since there was some degree of individual variation, the number of contractions performed per day ranged from ten to eighteen.

Each subject's 1 R. M. (the one-repetition maximum or the most weight that can be correctly carried through a full arc of motion once) was determined for the biceps, the knee extension and the hip-knee extension exercise.[1-2-3] Since motor learning produces a considerable increase in 1 R. M. during the first week of exercise, the 1 R. M. obtained at the beginning of the second exercise week is used as the initial strength index. This 1 R. M. was used as the basis for each subject's progressive resistance exercise prescription, was re-checked weekly, and as it increased a new prescription was written so that the muscles were always working against approximately the maximum resistance possible for them to overcome.

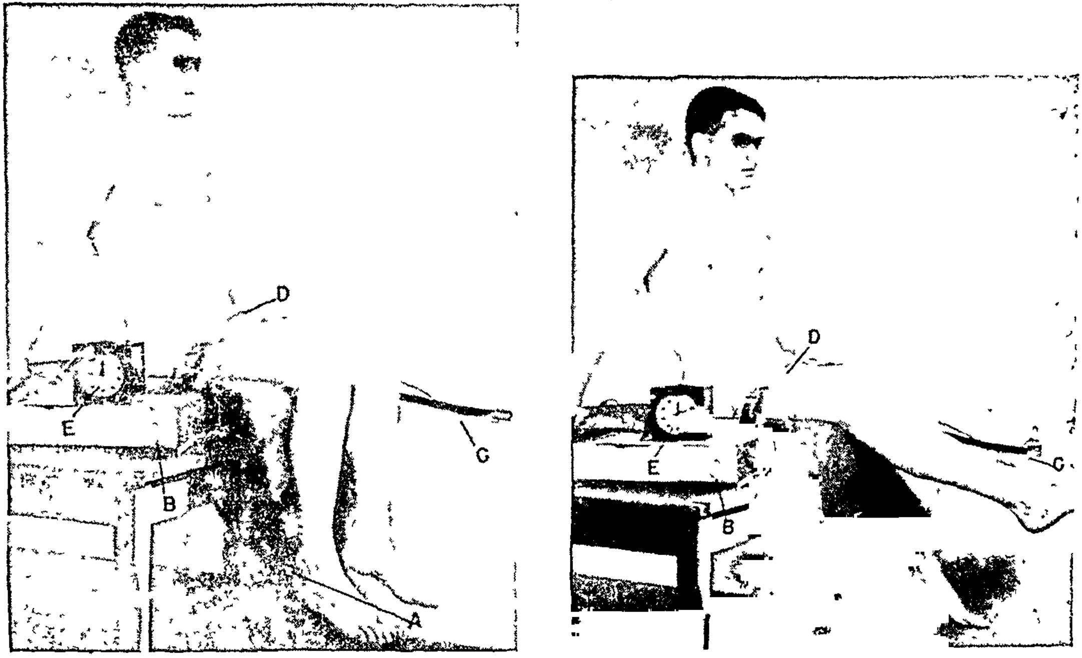

Fig 2a

Fig. 2b.

Fig 2a and 2b. — A — Switch initiating recording by electric timer. Timer starts when foot is removed from switch. B — Pilot light which turns on when contact is made with switch A. C — Bar which controls switch for stopping timer, when bar is struck by foot, timer stops. D — Strap for keeping thigh fixed to table. E — Electric timer.

Data and Discussion

Muscle Hypertrophy and Strength. — Measurement of muscle hypertrophy under laboratory conditions is far from easy, and under the limitations imposed by clinical conditions the task is even more difficult. In this study circumferential upper arm and thigh measurements were made as carefully as possible at the beginning and at the end of the experimental period. The thigh was measured in full extension at a given distance above the patella; the upper arm was measured both flexed and extended at its point of greatest diameter (table 1). The only purpose of these measurements was to determine whether change in limb diameter occurred during the exercise period. A significant increase in these diameters in the exercise subjects, in the absence of any change in the control subjects' measurements, would seem to constitute evidence of increase in muscle mass.

TABLE 1. — *Changes in Biceps and Quadriceps Circumference During the Experimental Period in Both the Group Which Exercised Those Muscles and in the Control Group Which Did No PRE.*

Subject	Number of Workouts	Increase in Arm Circumference		Increase in Arm Circumference Upon Flexion		Change in Thigh Circumference Inches
		Relaxed Inches	Contracted Inches	Before PRE Inches	After PRE Inches	
L. C.	31	¼	¼	1¼	1½	Plus ¾
A D.	41	0	¼	1	1¼	Plus ½
R. E.	35	¼	½	1	1½	Plus ½
E. R.	39	¼	⅞	1½	2⅛	Plus 1¾
E. C.	42	½	¾	1¼	1½	Plus ¾
J. M.	0	¾	½	......	......	0
N. R.	0	0	0	1	1	Minus ⅛
R. P.	0	0	¼	1¼	1½	0
G. S.	0	0	0	1	1	0
C. W.	0	0	¼	1¼	1½	0

The data in table 1 have to be evaluated with the fact in mind that the measurement method used is not a precise one. However, it seems fair to say that the exercise subjects showed an increase in limb circumference, whereas the control subjects showed little, if any, difference between their initial and final measurements Four of the five exercise subjects showed an increase of from ¼ to ½ inch in their relaxed arm circumference, while only one of the controls showed any gain. All of the subjects who exercised showed an increase of from ¼ to ⅞ inch in their contracted arm circumference (mean, ½ inch) whereas in only three of the controls was there an increase, and the mean of these was less than ¼ inch. At the end of the experimental period all those who had done progressive resistance exercise showed a greater difference between their arm circumference when measured at rest and then in contraction than had been present initially. (The mean increase was ⅜ inch.) During this same period only two of the controls showed any increase, (¼ inch).

The thigh measurements (table 1) show an increase in circumference of from ½ inch to 1¾ inches (mean, approximately ⅞ inch) for all members of the exercise group, whereas no member of the control group showed an increase. In spite of the inaccuracies of the measurement method it seems reasonable to conclude that the progressive resistance exercise produced an increase in these subjects' muscle mass.

Strength was measured in terms of the 1 R. M. This is a crude test of muscle strength; but in normal subjects in whom it is desired only to determine gross strength, it is adequate. There was no increase in the 1 R. M. for any of the exercises by any member of the control group. Increases of from 50 per cent to 71 per cent (mean, 59 per cent) were produced by biceps exercise, of from 28 per cent to 70 per cent by knee-extension exercise (mean, 49 per cent) and of from 23 per cent to 60 per cent by hip-knee extension exercise (mean, 42 per cent). No subject in the exercise group failed to increase his 1 R. M. in any of the three exercises: the smallest increase in 1 R. M. was 23 per cent (table 2). When muscle size, as well as muscle strength, is found to have increased, it can be assumed that strength has increased on a structural basis and is not due to motor learning alone.

Soft tissue x-rays of both the right and left biceps were made before and after the exercise period. However, despite careful efforts in positioning each subject, it was subsequently found that differences in elbow flexion from two to ten degrees existed between initial and final films. Since the

TABLE 2. — *The Per Cent Increase in 1 R.M. for Each of the Subjects Who Exercised Their Biceps and Quadriceps. None of the Control Subjects Showed Any Increase in 1 R.M.*

Subject	Number of Workouts	Per Cent Increase in 1 R. M. Biceps	Knee Extension	Hip-Knee Extension
L. C.	31	50	61	40
A. D.	41	63	44	52
R. E.	35	71	70	36
E. R.	39	65	44	60
E. C.	42	50	28	23

mean arm circumference increased about 1.25 inches from 180 degrees extension to 90 degrees of flexion, measurements taken from other than perfectly positioned x-rays could be of little significance, particularly when the differences between initial and final x-ray measurements were as small as was the case here. These data allow no more than the comment that the x-rays reveal no reliable evidence of increase in biceps diameter in either of the groups.

Contraction Time. — Table 3 lists the elbow-flexion contraction time (in hundredths of a second) for each of the five subjects who exercised their biceps and for each of the five controls. Each of the ten subjects was tested in the manner shown in figures 1a and 1b on from five to ten different days both before and after the four month exercise period. The mean contraction time of elbow-flexion for the five subjects was almost identical for the pre-exercise and the post exercise period: eleven and one-tenth hundredths of a second for the former and 11.2 hundredths of a second for the latter. The control group, which did no exercise, also showed no difference in the mean

TABLE 3. — *Elbow-Flexion Contraction Times (in Hundredths of a Second) of Each Member of Both the Control and the Exercise Groups.*

		ELBOW FLEXION										
		Controls					Exercised Group					
Subject		1	2	3	4	5	6	7	8	9	10	
	10								12.2			
	9		14.1						11.4			
	8		11.6		12.5	12.7	10.8	12.2	10.1		12.7	
	7		12.2		12.2	13.5	11.7	12.0	10.2		13.5	
	6		11.7	12.1	13.0	12.1	11.2	11.5	9.3	10.2	12.1	
Trial Number	5	11.3	11.9	11.7	12.6	11.5	10.7	11.1	10.8	10.3	11.5	Pre-exercise Period
	4	11.8	11.3	10.9	11.3	11.9	10.8	11.1	11.5	9.7	11.9	
	3	11.4	13.3	11.3	10.7	10.9	11.0	11.7	11.2	9.5	10.9	
	2	10.2	11.8	11.2	11.3	10.5	11.2	11.7	11.0	10.3	10.5	
	1	11.0	12.0	11.2	10.9	11.7	10.7	11.8	11.6	9.7	11.7	
11.8*		11.1	12.2	11.4	11.8	11.9	11.0	11.6	10.9	10.0	11.9	11.1*
	1	11.1	12.5	11.3	11.4	12.8	11.9	11.2	11.7	10.5	11.6	
	2	10.7	12.6	11.8	11.8	11.6	10.1	11.5	11.0	11.0	10.4	
	3	11.1	13.4	11.6	12.8	12.3	11.6	12.0	12.5	10.8	11.7	
	4	11.1	11.6	11.8	10.5	11.4	11.5	11.0	10.8	10.2	11.2	
Trial Number	5	10.8	12.3	11.3	11.8	11.3	12.5	10.9	11.8	10.1		Post-exercise Period
	6		13.0	11.2		11.7		11.2	11.3			
	7							10.3				
	8							11.0				
11.7*		11.0	12.6	11.5	11.7	11.9	11.5	11.1	11.5	10.5	11.2	11.2*

* These averages and all times are in hundredths of a second.

contraction times, that for the pre-exercise period 11.8 hundredths of a second and for the post-exercise period, 11.7 hundredths of a second. Most of the subjects of both groups showed different mean contraction times in the post exercise period; this, however, did not affect the statistical stability of the data, for these differences were small (only 1 exceeded 0.6 hundredths of a second) and varied in both directions, some contraction times being longer after the exercise bout and others shorter.

Table 4 lists similar data for knee extension contraction time. Both the exercise and the control group showed a significant decrease in knee-extension mean contraction time from the pre-exercise to the post-exercise period. The decrease in mean contraction time was slightly greater, though not significantly so, for the exercise group (2.2 hundredths of a second) than for the control group (1.6 hundredths of a second). All members of both the control and the exercise group showed a reduction in contraction time and in all probability this was due to some undetected alteration in technique or apparatus. Since, however, all subjects of both groups were subjected to this factor the validity of the data is not destroyed.

TABLE 4. — *Knee-Extension Contraction Times (in Hundreths of a Second) of Each Member of Both the Control and the Exercise Groups.*

		KNEE EXTENSION										
		Controls					Exercised Group					
Subject		1	2	3	4	5	6	7	8	9	10	
	10								15.6			
	9		15.7				14.8		15.1			
	8		15.4		15.3	15.5	16.4	14.2	15.3		17.1	
	7		15.4		16.6	16.8	14.9	14.5	14.5		16.4	
	6		15.3	14.7	16.1	15.8	14.8	13.3	16.1	13.6	15.8	
Trial Number	5	15.6	15.7	14.5	16.1	14.5	14.2	13.0	13.0	13.7	15.5	Pre-exercise Period
	4	14.6	14.7	14.4	14.5	15.0	14.2	13.2	14.4	15.6	14.9	
	3	13.9	15.1	14.5	14.0	13.6	13.7	13.2	15.7	13.4	14.9	
	2	13.9	14.5	15.6	14.6	14.7	13.1	12.2	14.9	13.4	14.5	
	1	14.0	15.3	14.8	15.0	14.8	14.3	13.3	16.6	13.9	14.4	
15.0*		14.4	15.2	14.8	15.3	15.1	14.5	13.4	15.1	13.9	15.4	14.5*
	1	13.2	12.9	13.9	13.7	14.8	11.6	12.1	13.2	12.2	12.4	
	2	13.8	12.3	13.4	12.6	13.2	12.1	12.0	12.0	12.1	12.5	
	3	13.0	14.9	14.0	13.5	13.1	12.6	13.0	12.9	12.9	12.3	
	4	13.5	13.7	13.9	12.4	12.7	11.1	11.7	12.8	13.2	13.0	
Trial Number	5	13.2	14.3	14.0	13.5	11.9	11.4	11.3	14.0	12.2		Post-exercise Period
	6		13.6			12.2	11.8	12.5	11.5			
	7						13.3	11.0				
	8							11.1				
13.4*		13.3	13.6	13.8	13.1	13.0	12.0	11.8	12.7	12.5	12.6	12.3*

* These averages and all times are in hundredths of a second.

From the data in tables 3 and 4 it may be concluded that the progressive resistance exercise given did not significantly increase these subjects' muscle contraction time. It is conceivable that other individuals might react differently or that progressive resistance exercise given in a different manner or over a longer period of time might increase contraction time; but under the conditions of this study, which closely simulated clinical practice, there is no evidence that progressive resistance exercise results in increased muscle contraction time.

Summary and Conclusion

The purpose of this study was to investigate the effect of Progressive Resistance Exercise, when applied in a manner similar to that used in clinical practice, upon muscle contraction time. Two groups of subjects were used: one group served as controls and did no exercise, the other was given progressive resistance exercise.

Measurements of biceps circumference, thigh circumference and the 1 R. M. for elbow-flexion and knee-extension were taken on all subjects both before and at the end of the four months' exercise period, in order to determine whether actual changes in muscle strength and hypertrophy had been produced by the progressive resistance exercise.

Knee-extension and elbow-flexion contraction time was measured on all subjects in both the pre-exercise and the post-exercise period. At the end of their four months exercise regime there was an increase in biceps and thigh circumference and a considerable increase in knee-extension and elbow-flexion 1 R. M. Those findings indicate that progressive resistance exercise as administered had effected a change in those muscles. The results of the post-exercise contraction time tests offer no evidence that the progressive resistance exercise produced a slowing of contraction time in those subjects.

This study indicates that progressive resistance exercise given in the manner usually employed clinically does not increase muscle contraction time. Further study of more individuals, utilizing exercises over a longer period of time so that greater increases in muscle hypertrophy can be obtained, is necessary in order to verify this tentative conclusion.

30th Annual Session

SCIENTIFIC EXHIBIT SPACE

Requests for applications for scientific exhibit space in connection with the 30th Annual Session to be held at The Roosevelt, New York, New York, August 25, 26, 27, 28, 29, 1952, are being received. Address all communications to the American Congress of Physical Medicine, 30 North Michigan Avenue, Chicago 2.

PHYSICAL MEDICINE AND REHABILITATION FOR THE HANDICAPPED WORKER OVER FORTY

A Retrospect *

FRANK H. KRUSEN, M.D.

Among the problems which beset those of us who are "over forty," in addition to graying hair, lagging memories, bifocal glasses, loose dentures, and increasing waistlines, there is an unfortunate tendency to look back too much and to look forward too little. It was the great physician, Sir William Osler,[1] who said: "Many a man is handicapped in his course by a cursed combination of retro- and intro-spection, the mistakes of yesterday paralyzing the effort of today, the worries of the past hugged to his destruction, and the worm regret allowed to canker the very heart of his life. . . . Waste of energy, mental distress, nervous worries dog the steps of a man who is anxious about the future. Shut close, then, the great fore and aft bulkheads, and prepare to cultivate the habit of a life of Day-Tight Compartments." This philosophy of living chiefly in the present is a good one, not only for the handicapped workers in whom we are interested, but also for those of us who devote our attention to their care. Believing, as I do, that we should live chiefly in the present, I ask you to look back only enough to judge from the past what the future may hold, and to look forward with me only sufficiently to plan wisely, without apprehension, for the future.

While we continue to serve the handicapped by living each day to itself with no regret for, and no undue pride in, the past and with no qualms and no extravagant yearnings for the future, we can study the past objectively in the hope of making sound progress in the future.

My purpose is to look back on the history and weak beginnings of physical medicine and rehabilitation and to show that this new special field of medical endeavor offers the solution of the problems of the rehabilitation of the handicapped worker over forty and indicates that we should make every effort, in the future, to increase the number of centers devoted to this work. Past experience has taught us that in order to achieve prompt and adequate rehabilitation of the disabled person, in addition to appropriate medical and surgical care, we must provide suitable physical rehabilitation, satisfactory psychosocial adjustment, vocational advisement, and vocational placement.

Looking back on the development of physical medicine and rehabilitation, we can see that this new combined medical field offers the solution for proper rehabilitation of the older handicapped worker; therefore, all of us should strive mightily to organize centers of physical medicine and rehabilitation in various communities throughout this nation.[2]

Looking Back Briefly

The late Dr. Simon Baruch, distinguished New York physician and the father of Bernard M. Baruch, who has given so generously of his personal fortune for the advancement of our field, was perhaps the earliest pioneer in

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* Read at the Conference on Rehabilitation of the Handicapped Worker Over Forty at the University of Michigan, Ann Arbor, Michigan, July 11-13, 1951.

[1] Osler, William: A Way of Life. New York, Paul B. Hoeber, Inc., 1937, 41 pp.

[2] Krusen, F. H.: National Program in Rehabilitation Must Be Expanded, Minnesota Med. 34: 47 (Jan.) 1951.

rehabilitation of the aged.[3] Over sixty-five years ago, long before the term "rehabilitation," as we now use it, was known, Simon Baruch, as chairman of the attending staff of the Montefiore Hospital for the Chronically Ill, wrote: "It will be a proud achievement when our records will tell that a goodly proportion of those who have entered our gates, only to die in peace, have again issued from them entirely or partially restored, and enabled again to enter upon the battle of life from which they had regarded themselves as permanently banished."[4] This is the very essence of the idea incorporated in the philosophy of the rehabilitation of the older handicapped worker and his restoration to the fullest possible physical, mental, social, vocational and economic usefulness.

It will not always be easy to determine just which handicapped workers are really "over forty," because not only will some of them hesitate to confess to their real age, but a worker who has a chronologic age of forty may have a physiologic age of fifty, a mental age of twelve, an emotional age of ten, and a moral age of four. A worker who is senescent is not necessarily senile.[5] Senescence is the inevitable physiologic process of growing older, and is not a disease in itself, whereas senility implies abnormal aging.

In following Dr. Baruch's lead toward the physical rehabilitation of older persons, physicians gained most of their experience, strangely enough, from the development of programs for rehabilitation of younger persons. It was our experience with the restoration of the casualties of war which finally led to the modern developments in physical medicine and rehabilitation. World War I gave the first impetus to the development of this specialty. World War II brought it rapidly to a point of complete recognition.[6]

The Council on Physical Medicine and Rehabilitation of the American Medical Association, the Baruch Committee on Physical Medicine and Rehabilitation, and numerous other organizations have been instrumental in bringing this field of endeavor to its present level of achievement.[7] During and since World War II, the inspiring work of Dr. Howard A. Rusk, professor of physical medicine and rehabilitation at New York University, has focused attention on the rehabilitation aspects of the field. In the meantime, sound practice, wise teaching, and meticulous research have placed our work on an ever sounder scientific basis. In 1947, an American Board of Physical Medicine and Rehabilitation was established to qualify physicians in this special field of practice; and in 1949, the American Medical Association established a regular Section on Physical Medicine and Rehabilitation.

In 1939, there were only five residencies in this special field, available at three centers. Today there are eighty residencies, available each year, at forty different centers. Before the last war, there were only a few rehabilitation centers in the entire country. Now they are springing up all over the nation. The whole program is accelerating at a rapid pace. It seems obvious that we cannot relax if we wish to keep pace with the fast-moving programs to provide adequate rehabilitation for the older handicapped worker.

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[3] Krusen, F. H.: Simon Baruch — American Pioneer in Physical Medicine and Rehabilitation, Life and Health 64:16 (June) 1949.

[4] Report of the Chairman of the Staff of the Montefiore Hospital for the Chronically Ill. Simon Baruch, M.D., October 30, 1886: Quoted by Krusen, F. H.3

[5] Pepper, O. H. P.: The Principles of Diagnosis and Treatment of Disease in the Elderly. Nebraska M. J. 24:401 (Nov.) 1939.

[6] Krusen, F. H.: The Future of Physical Medicine, M. Ann. District of Columbia 14:239 (June) 1945.

[7] Krusen, F. H.: The Scope and Future of Physical Medicine and Rehabilitation, J. A. M. A. 144:727 (Oct. 28) 1950.

Nature and Magnitude of the Problem

One of the topics under discussion during this conference has to do with the nature and magnitude of the problem. To understand the nature of the problem, we should be familiar with certain definitions. *Physical medicine* may be thought of as applied biophysics. The specialist in physical medicine and rehabilitation employs various physical agents and devices, therapeutic exercises, corrective procedures, occupational therapy and physical rehabilitation in the diagnosis and treatment of diseases and injuries.

Occupational therapy may be defined as medically prescribed activity which has a therapeutic objective.

Rehabilitation may be defined as the preparation of the patient, physically, mentally, socially and vocationally for the fullest possible life compatible with his abilities and disabilities.[8] Dr. Henry H. Kessler,[9] one of the great leaders in our field, has said: "Rehabilitation has acquired new connotations growing out of civilian and military experience. It has come to be regarded as a creative process in which the remaining physical and mental capacities of the physically handicapped are utilized and developed to their highest efficiency. It is an organized and systematic method by which the physical, mental and vocational powers of the individual are improved to the point where he can compete with equal opportunity with the so-called non-handicapped." To paraphrase McKee Fisk,[10] of the Veterans Administration, the final test of rehabilitation is permanent employment at a job consistent with the ability and preparation of the worker at a wage at the going rate. Thus, the final responsibility of the rehabilitation program is to assist the disabled worker to obtain satisfactory employment, doing that for which he was trained.

To provide some idea of the magnitude of the problem, it has been estimated[2] that to staff an adequate system of rehabilitation facilities in this country, it would be necessary to recruit and train 2,500 to 3,000 medical specialists and 10,000 to 12,000 more physical therapists and occupational therapists, as well as several times 10,000 nonmedical rehabilitation personnel, such as psychologists, social service workers, and vocational rehabilitation counsellors. Furthermore, each year about 250,000 men and women are so disabled by injury or disease that they become incapable of holding a job or of enjoying a normal life. Altogether there are many millions of handicapped people in the United States today. Surveys have indicated that one and a half million of them, not including veterans disabled in service, would benefit greatly from rehabilitation services. A very high percentage of these handicapped persons is included among the workers over forty. It has been estimated, by a projection based on the latest census, that by 1980 more than 40 per cent of our entire population will be forty-five years of age or older.[11] There can be, therefore, no question about the magnitude of the problem we are discussing. The number of civilian casualties far exceeds the number of war casualties. Whereas, some 265,000 men were permanently disabled as a result of combat injuries during World War II, one and a quarter million civilians were permanently disabled, by accidents alone, in the corresponding four years.

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[8] Krusen, F. H.: Physical Medicine and Rehabilitation in the United States of America With Special Reference to the Influence of the Baruch Committee on Physical Medicine and Rehabilitation in Its Development, Brit. J. Phys. Med. n. s. 13:169 (Aug.) 1950.

[9] Kessler, H. H.: Rehabilitation of the Physically Handicapped, New York, Columbia University Press, 1947, 274 pp.

[10] Fisk, McKee: Medical and Vocational Rehabilitation for Veterans. In: Symposium on the Processes of Rehabilitation. National Council on Rehabilitation, New York, 1944, 32 pp.

[11] Erickson, D. J., and Krusen, F. H.: Physical Therapy Comes to the Aid of the Aged, Mod. Hosp. 62:88 (May); 88 (June) 1944.

Miss Mary Switzer,[12] director of the Office of Vocational Rehabilitation, has pointed out that we shall need two million new workers one and a half years from now. She asked, "Where are we going to find the man power to carry on?" She stressed the point that conservation of our human resources is a community responsibility and that men of education, men of medicine, men of science and men of business must combine to take their share in this conservation program. She said pertinently that people are not rehabilitated; they are only given an opportunity to rehabilitate themselves. Rehabilitation is a bridge spanning the gap between uselessness and usefulness, between hopelessness and hopefulness, between despair and happiness.

Taking one last look backward, I believe we can conclude that the patterns have been established for the rehabilitation of the older handicapped worker. Therefore, we can turn with enthusiasm to the enormous task of organization and expansion of physical medicine and rehabilitation centers throughout this land. The high motivation and keen enthusiasm of many of the older participants at this three-day conference indicate definitely that for many persons, as claimed by Walter Pitkin,[13] "Life begins at forty." Thus, when we discuss the rehabilitation of handicapped workers over forty, we are talking about a group who often have tremendous energy and who, properly guided, have much to contribute toward the welfare of our nation.

Medical Aspects

Another topic we have been discussing has to do with the medical aspects of the rehabilitation of the worker over forty. Physicians have an enormous responsibility in contributing toward this humanitarian program. Years ago, Descartes[14] wrote, "If ever the human race is raised to its highest practical level intellectually, morally and physically, the science of medicine will perform that service." It was Dr. Raymond B. Allen,[15] the famous medical educator, who said: "The medicine, science, and scholarship of tomorrow's world must forever be free to serve the peaceful needs of all mankind. . . . Medicine, with its age-old concern for the sick — the poor as well as the rich, the weak as well as the strong, has been an influence for good surpassed only by the moral precepts of religion. . . . Medicine is coming of age as a social science in the service of society. It takes a man, not a machine, to understand mankind."

The medical centers, now, must vastly increase their training programs so that an adequate supply of medical specialists in physical medicine and rehabilitation (now called physiatrists), psychiatrists specially trained in the problems of the disabled, physical therapists and occupational therapists, must be provided to staff the ever-increasing numbers of rehabilitation centers. Then only will these centers be able to rehabilitate handicapped workers.

The development of programs of rehabilitation is primarily a teaching effort. In addition to the categories previously mentioned, medical centers must train more psychologists, social workers and vocational counsellors. Furthermore, in modern rehabilitation centers, we must constantly teach our patients new skills. To do this, we must first select good students. Good students and willing workers usually will labor continuously and conscientiously and soon can be trained in the fundamentals of this new and broad approach to medical care. The late great Harvard physiologist, Walter B.

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12. Switzer, Mary E.: Disability and Rehabilitation, Acuff Clin. Bull. 2:3 (Apr.) 1951.
13. Pitkin, Walter: Life Begins at Forty. New York, McGraw-Hill, 1932, 175 pp.
14. Descartes, René: Quoted by Allen, R. B.[15]
15. Allen, R. B.: Medical Education and the Changing Order. New York, The Commonwealth Fund, 1946, 142 pp.

Cannon[16] has said, in discussing "passing on the torch," that a few students neglect their studies until shortly before examination time and then work furiously to catch up. Cannon called such students "long distance putters" because they suggested to him the story of the complacent golfer who teed his ball, looked away to the next green and declared confidently, "That's good for one long drive and a putt." He swung his driver, tore up a stretch of sod and managed to move the ball a few feet off the tee. The caddy then stepped forward, handed him the putter and suggested, "Now for a hell of a putt!" Suffice it to say that we must find many students who are not "long distance putters." In training our patients in new skills, we must see that they start hard work at once and do not lag behind, hoping that a few months hence they will achieve complete rehabilitation by a "long distance putt."

Psychosocial Problems

Another of our topics has been that of the psychosocial problems. Certainly the key to the rehabilitation of a disabled person is the provision of proper motivation. The handicapped worker must learn, to begin with, to be like the charming young woman who, after losing both her legs, suddenly said to her physician one day, "I have just realized that instead of making the *best* of it, from now on, I'm going to try to make the *most* of it!" Even some of our keenest observers have not fully understood the implications of modern rehabilitation and then have suddenly come to the realization of how the disabled are now being trained to "make the most of it." For example, in 1948 David Hinshaw[17] wrote: "For years I had closely followed the work [of the Institute for the Crippled and Disabled in New York City] and yet I had missed the emergence through it of the miracle of the composite science of rehabilitation. Suddenly I realized that its staff was using medicine and surgery, psychology and psychiatry, therapy, patience, kindness, friendly understanding, and vocational training in their efforts to help the physically handicapped reeducate themselves to live and work and love by enlisting their minds, hearts, and bodies."

I am glad that Hinshaw mentioned the word "love," because love and romance are still highly important even to the older handicapped worker. It was the Baroness Burdett-Coutts who, at the age of ninety, was asked, "When does a woman stop hoping for romance?" She answered, "Goodness, I don't know yet!" Love and romance are among the chief sources of motivation of disabled persons. There is perhaps nothing else that will so "fire the soul." It was Jean de la Fontaine[18] who said in the seventeenth century, "Man is so made that when anything fires his soul, impossibilities vanish." Harold Russell,[19] the well known double-arm amputee, has told of the inspiration he had from learning that his fiancee still loved him. Then it was that he said, "It is not what you have lost that counts, but what you have left." So he redoubled his efforts to rehabilitate himself and soon was happily married.

That fine physician, the late Francis W. Peabody,[20] of Boston, once said: "Disease at once affects and is affected by what we call the emotional life. . . . The good physician knows his patients through and through, and his knowledge is bought dearly. Time, sympathy, and understanding must be lavishly dispensed . . . the secret of the care *of* the patient is in caring *for* the patient."

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[16] Cannon, W. B. The Way of an Investigator, a Scientist's Experiences in Medical Research. New York, W. W. Norton & Co., Inc., 1945, 229 pp.

[17] Hinshaw, David. Take Up Thy Bed and Walk. New York, G. P. Putnam's Sons, 1948, 262 pp.

[18] de la Fontaine, Jean. Quoted by O'Connor, Basil. The Glory in the Limited Life. (Privately printed.) Georgia Warm Springs Foundation, Warm Springs, Georgia, 1951, 15 pp.

[19] Russell, Harold. Victory in My Hands. New York, Creative Age Press, 1949, 280 pp.

[20] Peabody, F. W. Doctor and Patient. New York, The Macmillan Co., 1939, 95 pp.

Economic Implications

I shall not discuss the economic implications, except to quote Bernard M. Baruch,[21] who said, "The investment in rehabilitation is an investment in the greatest and most valuable of our possessions, the conservation of human resources." Every handicapped worker who is rehabilitated and all of us who are striving to develop outstanding programs of rehabilitation owe a tremendous debt of gratitude to this great man. He has given generously of his personal fortune; he has provided unstintingly of his tremendous store of wisdom; and he has lifted us up and pushed us forward by offering liberally of his immense prestige. He has provided the means for establishing three large key centers of physical medicine and rehabilitation; he has supported programs in research and teaching in medical centers throughout the nation; he has given fellowships to over fifty young physicians; and he supported vigorously the educational efforts of his committee of scientists who worked intensively for eight years to establish physical medicine and rehabilitation on a sound basis.

The generosity of Mr. Baruch and the earnest efforts of the group of scientists who worked with him, have made the prospects for rehabilitation of the handicapped worker over forty brighter than ever before. One man, aided by one small group of educators and investigators, however, cannot hope to finish this task. As Miss Switzer has said, conservation of our human resources is a community responsibility in which all of us must participate. Each one concerned must redouble his efforts and must labor unremittingly to expand the rehabilitation programs which have been inaugurated under such auspicious circumstances.

In closing, I should like to quote the beautiful statement of John Galsworthy,[22] famed novelist. Years ago, just after World War I, Galsworthy said: "Restoration is at least as much a matter of spirit as of body, and must have as its central truth: Body and spirit are inextricably conjoined. To heal the one without the other is impossible. If a man's mind, courage and interest be enlisted in the cause of his own salvation, healing goes on apace, the sufferer is re-made; if not, no mere surgical wonders, no careful nursing, will avail to make a man of him again. Therefore, I would say: 'From the moment he enters the hospital, look after his mind and his will; give him food; nourish him in subtle ways; increase that nourishment as his strength increases. Give him interest in his future. Light a star for him to fix his eyes on, so that, when he steps out of the hospital, you shall not have to begin to train one who for months, perhaps years, has been living, mindless and will-less, the life of a half-dead creature.'

"That this is a hard task none who knows hospital life can doubt. That it needs special qualities and special effort, quite other than the average range of hospital devotion, is obvious. But it saves time in the end, and without it success is more than doubtful. The crucial period is the time spent in the hospital. Use that period to recreate not only the body, but mind and will power, and all shall come out right; neglect to use it thus and the heart of many a sufferer and of many a would-be healer will break from sheer discouragement. A niche of usefulness and self-respect exists for every man however handicapped; but that niche must be found for him. To carry the process of restoration to a point short of this is to leave the cathedral without a spire. To restore him, and with him the future of our countries, that is the sacred work."

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[21] Baruch, B. M.: Introduction. In. Rusk, H. A., and Taylor, E. J.: New Hope for the Handicapped. New York, Harper & Bros., 1949, 231 pp.

[22] Galsworthy, John: Quoted in the Report of the Baruch Committee on Physical Medicine. (Privately printed.) New York, April, 1944, 50 pp.

DAILY ACTIVITY TESTING IN PHYSICAL THERAPY AND REHABILITATION *

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and

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Introduction

Daily activity measurement in physical therapy and rehabilitation is rapidly progressing from a lusty infancy toward adolescence. The comparatively recent work of Sheldon,[1-2] Deaver and Brown,[3-4-5] Bennett and Stephens,[6] Buchwald,[7] and others attest to the present activity in functional testing. However, daily activity measurement will have passed adolescence only when functional tests are properly graded, scored, validated, and normed, and their all-round practicability and utility demonstrated. This paper makes no pretense of being a complete treatment of statistical methods. *It will attempt to present a unique format for the administration of a useful daily activity test and promote the system of grading and scoring employed.* Validation and norms are still in the exploratory stage and will be reported in a future paper. In speaking of the development of suitable tests, a distinguished psychologist once stated "the tree is not too far from the apple." Thus, once the qualities to be measured have been determined, and the method for evaluating the degree to which the individual possesses these qualities has been agreed upon, validation and norms should not be too far remote.

The following discussion concerns a test generally used in the Physical Rehabilitation Section of the New York State Rehabilitation Hospital, West Haverstraw, New York, a description of its purpose, development, administration and the use of results.

The purpose of the test is to facilitate the training of patients in the essential activities of daily living by clearly indicating to the physician and therapist what the patient has accomplished to date and what remains to be achieved. This functional training* involves the reestablishment of a lost function or the establishment of substitution for a lost function by teaching patient to walk with braces and crutches, and to learn self-care by means of simplified techniques. Here are included the objectives of learning how best to handle the body in overcoming the residual effects of the disability, and the efficient use of acquired strength and learned skills in practical everyday living, with a view toward complete independence and self-sufficiency.

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1. Sheldon, Marjorie P.: Physical Achievement Record for Use with Crippled Children, Jour. Health and Physical Ed. 5:5 (May) 1935.
2. Sheldon, Marjorie P.: Testing Functional Ability in the Orthopedically Handicapped, Pub. Health Nursing (Feb.) 1945.
3. Deaver, George G., and Brown, Mary Eleanor: Physical Demands of Daily Life, Institute for Crippled and Disabled, 400 First Avenue, New York 10, New York, 1945.
4. Brown, Mary, Eleanor: Daily Activity Testing and Teaching, The Phys. Therapy Rev. 27:4 (July-August) 1947.
5. Brown, Mary Eleanor: Daily Activity Inventory and Progress Record for Those with Atypical Movement, Am. Jour. Occupational Therapy, September-October, November-December, 1950, and January-February, 1951.
6. Bennett, Robert L., and Stephens, Hazel R.: Functional Testing and Training, The Physical Therapy Review 29:3 (March) 1949.
7. Buchwald, Edith: Functional Training, Phys. Therapy Rev. 29:11 (Nov.) 1949.

Shortcomings of Existing Daily Activity Tests

Williams and Brownell[8] have suggested that techniques of educational measurement are apt to reflect the concepts of the prevailing philosophy of a school program. They observe that when education is viewed as a science, precise measuring instruments are sought to evaluate the child's progress in school, and that when teaching is regarded as an art, scientific accuracy in measurement gives way to a more general evaluation of the child.

It is no less true in physical medicine than in education that we seek to evaluate the patient's improvement in the light of accepted concepts of rehabilitation. For example, if a program of physical rehabilitation is concerned with adult patients and the problem of "return to work," test items will include among other things, testing devices for "on the job" conditions and methods of evaluating patients in the physical requirements of a job. If a program is concerned with pre-school children, a test might reflect normal growth and development levels for various ages rather than activities of daily living, because of the physical immaturity of the child.

It is a useless procedure to conduct tests which contribute little or nothing toward desired objectives. Thus, in selecting tests in physical therapy and rehabilitation we must decide upon purposes and objectives and then consider what test and measurement items may best promote their achievement.

Various existing direct activity tests were used at the Rehabilitation Hospital as aids in determining the physical rehabilitation needs of the patient and in developing treatment plans to meet these needs. Each test selected and used failed to bridge the gap that existed between our aspirations for patients, as expressed in our purposes, and the actual functional accomplishments of the patient in the essential activities of daily living. This condition prevailed for several reasons. A common mistake of many daily activity or functional tests is that they undertake too much, and consequently, therapists feel that the tests are too lengthy and time consuming to administer in their present forms. Because the purposes of most of the tests used are too general, it is almost ludicrous to patient and therapist alike to evaluate performances in activities where it is self-evident that it can be accomplished. According to Ross[9] there is really only one fundamental purpose in all measurement, namely, to understand someone better. To contribute to the understanding of the individual, the test items should be appropriate for the individual and the purpose of the testing.

Present day daily activity tests fail, in most instances, to include enough endurance activities to meet the functional needs of the types of patients admitted at Haverstraw or their post-hospital environments. In other words, existing tests when modified for administration at this hospital, did not meet the needs of the activity "break-down" of the Physical Rehabilitation Section, nor permit maximum utilization of the section's equipment and facilities, which are designed to meet the "true-to-life" experiences of our particular types of patients.

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* Functional training and daily activities mean simply the activities essential for daily living, which ordinarily the average citizen takes for granted, but nevertheless, are necessary in order to live a life of independence. For example, the disabled individual has to walk up and down steps, get in and out of bed, be able to get from wheelchair to an ordinary chair or from a wheelchair to an erect position, etc..

[8] Williams, Jessie Feiring, and Brownell, Clifford, L.: The Administration of Health and Physical Education, W. B. Saunders Co., Philadelphia and London, 1939.

[9] Ross, C. C.: Measurement in Today's Schools, Prentice-Hall, Inc., New York, 1947.

Against some daily activity tests, it has been argued that they are difficult to grade and score. Many tests completely lack or take for granted a system of grading and scoring, so that an analysis of test results is complicated and confusing. If daily activity tests are to permit therapists to do something about the situations revealed, then a system of grading and scoring should be employed that will facilitate interpretation and utilization of the results.

From the viewpoint of administration at this hospital, a new format for testing functional activities was indicated, since the Occupational Therapy Section presently tests and teaches approximately seventeen hand activities included in the average run of daily activitity tests.

Criteria for a Satisfactory Daily Activity Test

In constructing the present daily activity test it was necessary to set forth certain criteria against which the final product could be evaluated. An ideal test would possess a number of features which group themselves under two major objectives: *first,* the test should *reveal useful information* and *second,* it should be *administratively practical.*

With regard to the first of these objectives there are five areas in which the test should contribute to evaluation of the patient. *First,* it should show his ability or lack of ability to perform a variety of activities encountered in daily living. Since all activities cannot be tested, those activities appear in the test should be as representative a sample as possible, to include the most important tasks the patient will meet, and to approximate the actual conditions under which they will be performed following discharge from the hospital. The test should give some indication of his capacity for self-sufficiency in bed, within the home, in traveling, in doing housework, attending school, or working at a job wherever appropriate. *Second,* we should expect a measure of the patients' proficiency in performing these activities in terms of the time required, the assistance needed to perform the task or to meet requirements of safety, and his endurance in carrying them out. *Third,* since we are discussing an ideal test, it would be advantageous to ascertain the reasons for his failures, such as lack of muscle power, poor balance, inadequate training, fatigability, apprehensiveness. Despite the importance of this area, it would seem beyond the scope of the present test. Until such time that these factors can be isolated and measured in the form of a "Diagnostic Test of Functional Ability," it will be necessary to rely on the subjective judgment of the doctor and therapist to avoid these failures. *Fourth,* we should expect an indication of the over-all extent of the patient's rehabilitation and the amount of future progress that may be expected. *Fifth,* we should expect some general summation of the patient's present and probable future status as a custodial, wheelchair, or ambulant individual.

The second general objective stated above tends both to complicate and to restrict proposed features of an ideal test. *First,* the test should be applicable to bed, wheelchair, and ambulant patients, with and without apparatus, and of varying degrees of motor ability. *Second,* it should allow for progressive testing of recuperating patients from bed to upright locomotion. *Third,* it should permit recording of data from retests on the same sheet so that the patient's progress will be readily apparent without referring to a multitude of forms.

Fourth, it should provide separate indices of functional independence for different classifications of patients such as bed, wheelchair, and ambulant. Furthermore these should be an additional measure which would not be misleading when comparing patients in one classification with those in other classifications, and which would give an indication of the functional ability of a patient in comparison with a physically normal adult. Stated more concretely, we need to compare the wheelchair patient, for example, with the maximally independent wheelchair patient, to the ambulant or bed patient and to a physically normal adult. *Fifth,* we would benefit from a system of scoring which takes into account not only the number of activities accomplished, but the facility with which they were performed. Without adequate recognition of the latter, a spurious comparison may be obtained between two patients who perform the same number of activities, but with widely difficult degrees of skill. Similarly, we might tend to underrate the patient who did a few·things well, as compared with the patient with marginal ability on many items. *Sixth,* the test should be as concise and as brief as possible, eliminating duplication of activities and avoiding the testing of severely disabled or advanced ambulatory patients on activities inappropriate to their level of rehabilitation. *Lastly,* we would hope for the test to be as simple as possible to administer, score, and interpret.

Description and Use of the Test

The present test represents our efforts to satisfy as many of the above objectives as possible. Activities appearing in the scale were selected because they represented a variety of skills important in the rehabilitation of patients at this hospital. Whenever possible, unnecessary items which did not contribute to an over-all evaluation of the patient were eliminated. By providing separate scales on the same form for the testing of bed, wheelchair, or ambulant patients it was possible to limit inappropriate or duplicated activities and at the same time indicate to the therapist which items should or should not be tested for each type of patient. Such a format also permits successive evaluation of a patient at different stages of rehabilitation.

The test is composed of 76 activities arranged approximately in order of increasing difficulty. To the left of the description of the activity is the time limit (ST = Standard Time) allowed for performing the task. The times listed represent a crude average of the time required by patients who had achieved a maximum degree of rehabilitation to accomplish the activity under local conditions. In other hospitals it is expected that the time limits and perhaps the activities themselves will have to be modified. The right half of each test page consists of four columns labeled to indicate their use for patients described as "Bed," "Wheelchair," "Ambulant With Apparatus," and "Ambulant Without Apparatus." Within each column appears a series of four boxes opposite the description of the test activity. These boxes have been included wherever the test item is appropriate to the type of patient being examined, and a blank space indicates that the patient need not be examined on the item. Thus, there are 20 items for bed patients, 50 for wheelchair, 60 for ambulant with apparatus, and 40 for ambulant without apparatus. At the top of the column the significance of each box is indicated by the letters "PT," "P," "I," and "T," referring to "Performance Time," "Performance," "Independence," and "Time." In using the test, the patient attempts each item appropriate to his classification as *bed, wheelchair* or *ambulant.* The time required to perform the activity is entered in the box under the heading "PT," and his degree of success is indicated by symbols entered in each of the three boxes according to the scheme noted under "Key to Grading" in the second section of the sample test appearing at the end of this paper.

Key to Grading

In the reproduction of a sample test sheet which appears on pages 106-107 the "Keys" are listed as follows:

Unable to perform the activity.
Performs awkwardly or needs more practice.
Performs activity satisfactorily.
Unable to perform the activity without assistance.
Assistance necessary only for reasons of safety.
Performs activity independently.
Requires more than twice the allotted time.
Requires not more than twice the allotted time.
Able to do the activity within the allotted time.
Not tested.
Not applicable.
Unable to perform activity.
Performance within normal limits.

If for some reason the patient was not tested on an activity, the boxes are left blank, or if the activity was not applicable a horizontal line is drawn through the three boxes. It is suggested that the marking of the symbols for the initial testing be made in *black* and that marks for subsequent testing be made in *red*. Thus, a diagonal in red over a black zero or an X completed in red would show improvement. If desired, the right hand margin may be utilized to enter the date of accomplishment of items not successfully performed during the initial testing. In addition to permitting the recording of improvement, the breaking up of scoring into three factors with degrees of ability within each presents distinct advantages for interpretation. By various combinations of the above symbols it is possible to indicate a total of 19 degrees of proficiency, ranging from complete inability to independent performance within normal limits.

Patients may be tested as bed patients and then be given the wheelchair or ambulant scales as their progress warrants. Or a patient may be tested on two scales, such as wheelchair and ambulant with apparatus, to compare his functional ability in each. Where an activity does not require modification in applying to more than one classification, accomplishment in one column warrants credit in all columns where applicable, without retesting. For example, if a bed patient demonstrates his ability to dress and undress satisfactorily, he may be credited with this activity as a wheelchair or ambulant patient without retesting. On the other hand, the performance of certain items* varies as it applies to different classifications and must be given again when the patient progresses in his status. For example, No. 37 "To standard chair," in the case of a wheelchair patient means moving from a wheelchair to a standard chair, while in the case of an ambulant patient, it refers to his ability to seat himself from the erect position.

Summary of Test Performance

Summary Based on Complete Success or Failure. — Having administered the test to the patient and recorded his proficiency in performing the appropriate activities, a summation of his functional ability is desired. This may be done in several ways and can be as detailed as the needs of the situation demand. First, for the information of the therapist a glance at the symbols entered opposite the activities under *performance, independence* and *time* should give a qualitative indication of the patient's specific accomplishments and failures, his need for assistance, and the speed with which he performed the tasks. For purposes of training the patient, this is all that is required and no further scoring needs to be done. This item by item analysis will show specifically what the patient can and cannot do, and on what activities he requires further training. This is the primary concern of the therapist.

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* See test sheet, pp. 106-107, items 25, 26, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46 — 51, 52, 53 — 62, 63, 64 and 67.

If a summary is desired for use of the physician, preparation of reports, statistical studies, etc., provision is made at the end of the test for computing various totals and percentages. For a crude summary, count the number of items which the patient was able to perform within normal limits. Also count the number of items regarded as not applicable. The sum of these two is then entered in the appropriate space. The number of items the patient was totally unable to perform and the number of items on which he was not tested are similarly totaled and entered. The sum of these two entries will not equal the total of applicable items for his classification, since items which he accomplished marginally have not been included. The totals may easily be converted into percentages. It will be noted that the total number of items applicable to each classification has been adjusted to end in zero (i. e., is a multiple of ten) in order to facilitate division. To preserve this advantage, all "not applicable" items are included with items "performed within normal limits" in computing the percentage. Since the maximum number of "not applicable" items for each classification will be small in relation to the total, it is felt that the saving in time and ease of computation justifies the small degree of error, if any, which will result. The percentage of activities the patient was able to perform within normal limits ("per cent within normal") is thus calculated as follows: Divide the number entered opposite "Total within normal plus not applicable" by the number of items given on the sheet for that classification (Bed 20, Wheelchair 50, Ambulation With Apparatus 60, Ambulation Without Apparatus 40). Percentage of items completely failed ("per cent failed") is arrived at by the same procedure.

Summary Based on Partial Success or Failure. — Since the above totals and percentages fail to include items which were failed marginally, it is valuable to have a more accurate index of functional ability which takes into account the patient's degree of facility in performing the activities. This more accurate and detailed summation of the patient's physical accomplishments is obtained by assigning weights to the symbols so that degrees of facility can be quantified and an arithmetic total score obtained. In assigning numerical weights to the various symbols appearing in the sets of three boxes for each activity the values noted in the second section of the sample test under "Values of Symbols in Computing Weighted Scores" are used.

Using this system, the total weighted score for each column of boxes in the classification is counted and entered in the appropriate spaces opposite "Sum of weighted scores" and the three totals added together to comprise the "Total weighted scores." Computation of the percentage may be accomplished by dividing the latter total by the maximum weighted score possible as given on the test. The resulting percentage gives an index of the degree of rehabilitation the patient has achieved as a bed, wheelchair, or ambulant patient, as the case may be.

Since it is also desirable to know the patient's approximate functional capacity on the test as compared with that of a physically normal person, another percentage is required. The basing of such a percentage on a common standard permits direct comparison of bed patients with wheelchair patients, etc., and gives an over-all indication of functional capacity. No claims are made for the accuracy of the measure about to be described, but it is felt that it provides a reasonable comparison among patients in different classifications without the necessity of excessive computation.

Stated briefly, the logic behind the method of calculation is as follows: The test itself is comprised of 76 items. However, particularly in the case of wheelchair vs. ambulant patients, the manner of accomplishing the items changes from one classification to another. For example, we ask a patient to "move 300 feet." In one case he does the task in a wheelchair, in the other case by ambulation. In effect then, this is not one, but two activities. The same principle applies to a number of the items in the scale. We selected 24 items* which most obviously were performed at two levels, choosing this number in order to raise the total activities of the test to an even 100. All of the 24 items involved ambulant vs. wheelchair functioning and were not concerned with bed activities.

Now, if we accept the fact that a physically normal adult would be capable of performing all of the 100 activities on the scale (including the 24 items at both wheelchair and ambulant levels), and test a patient on all these activities, then his over-all functional capacity would be expressed in terms of the ratio between his test performance and the maximum score attainable on the entire test. This ratio would then be converted into a percentage of all activities of the test which he was able to accomplish. This would necessitate the process of eliminating duplicated items in counting his score. Furthermore in a practical situation we would generally test the patient only on those items applicable to his classification as a bed, wheelchair, or ambulant individual. If we assume that he would be able to accomplish the tasks applicable to lower classifications, on which he was not tested, and conversely fail those in higher classifications, then we can dispense with administering the test in its entirety. This assumption becomes more tenable in the case of wheelchair patients if we consider that complete or partial failures which might occur below his classification would tend to be balanced by complete or partial success on items at higher classifications. The problem then becomes one of giving the patient credit for easier items on which he was not tested. In the case of the wheelchair patient there are 8 bed items on which he would not be tested and these should be credited. There are 40 easier items to be credited in the case of patients ambulant with apparatus, and 60 items to be credited for patients ambulant without apparatus. The latter numbers are derived simply by subtracting the number of items appearing in the classification from the total of 100 items represented on the entire test.

The foregoing description explains how the present system of scoring was derived but need not be consulted in applying it. For purposes of a quick summary of over-all functional ability it is necessary only to note the number of items on a particular scale which were performed "within normal plus not applicable," and add to this a number which compensates for easier items not tested (for Bed add 0, for Wheelchair add 8, for Ambulation With Apparatus add 40, and for Ambulation Without Apparatus add 60). Since the maximum score has been adjusted to total 100, no further arithmetic is required and the resulting number represents the percentage of activities totally accomplished by the patient in relation to those of a physically normal individual ("Per cent of normal function").

If weighted scores have been calculated in order to take into account items accomplished with partial success, then a more accurate percentage of over-all functioning ability can easily be obtained. To the "Total weighted

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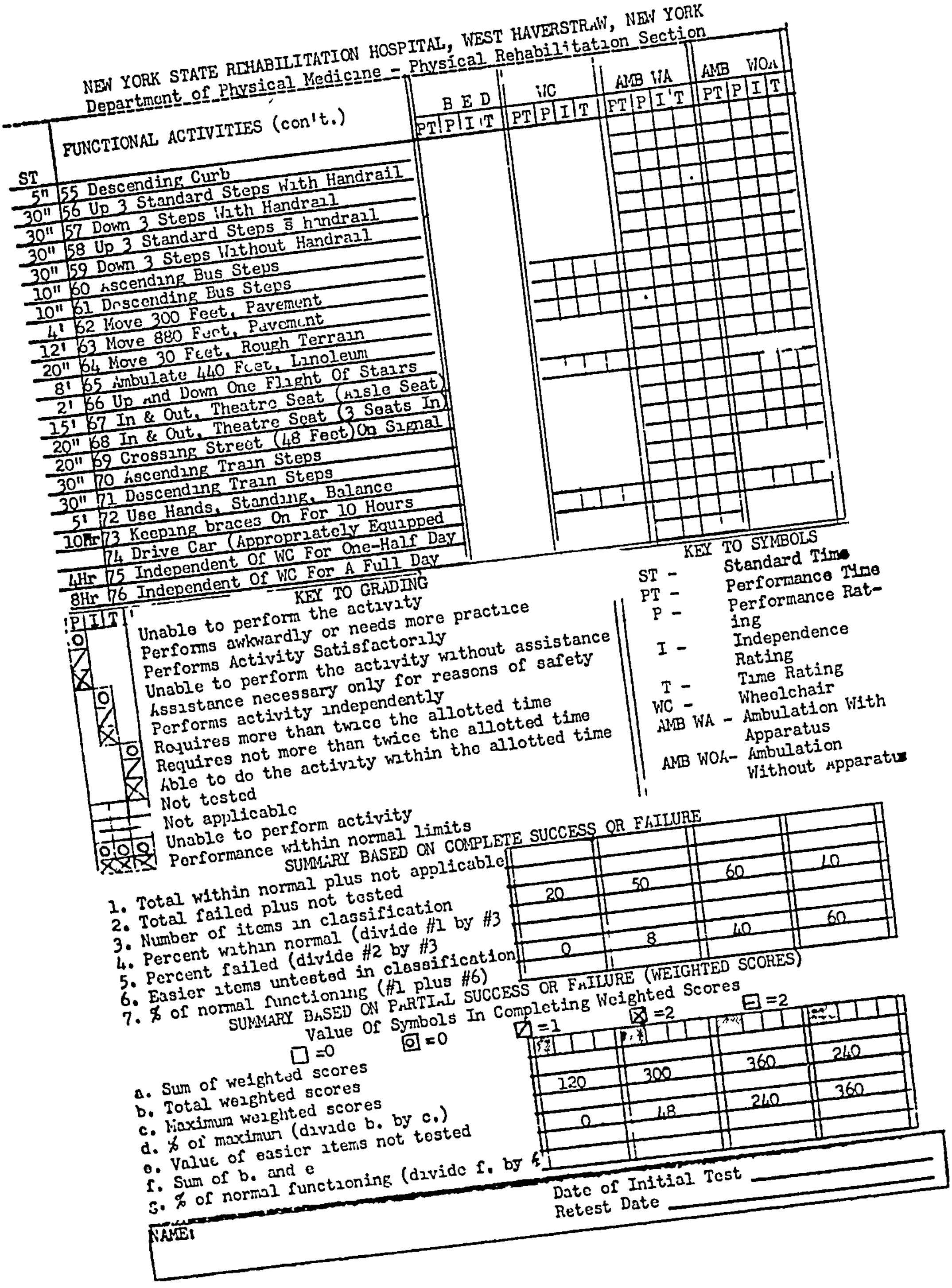
* As previously mentioned, an asterisk appears before these items on the test sheet (pp. 106-107).

Test Sheets.

NEW YORK STATE REHABILITATION HOSPITAL, WEST HAVERSTRAW, NEW YORK
Department of Physical Medicine - Physical Rehabilitation Section

ST	FUNCTIONAL ACTIVITIES	BED				WC				AMB WA				AMB WOA			
		PT	P	I	T	PT	P	I	T	PT	P	I	T	PT	P	I	T
15"	1 Roll From Supine To Prone																
15"	2 Roll From Prone To Supine																
10"	3 Move Toward Head Of Bed																
10"	4 Move Toward Foot Of Bed																
10"	5 Reach Night Stand, Left																
10"	6 Reach Night Stand, Right																
30"	7 On Bedpan																
30"	8 Off Bedpan																
10"	9 Cleansing After Toilet																
1'	10 Manage Clothing For Toilet																
1'	11 Readjust Clothing After Toilet																
10'	12 Give Self Bed Bath																
15"	13 Move From Supine To Sitting																
3'	14 Manipulate Corset, Sling - On																
1'	15 Manipulate Corset, Sling - Off																
15'	16 Putting On Braces																
10'	17 Taking Off Braces																
15'	18 Dress With Braces, Apparatus																
15'	19 Undress With Braces, Apparatus																
5'	20 Dress Without Braces, Apparatus																
5'	21 Undress Without Braces, Apparatus																
1'	22 Move 30 ft.(Sitting, Kneeling,Etc)																
15"	23 Ascend 3 Steps s̄ Braces, Crutches																
15"	24 Descend 3 Steps s̄ Braces, Crutches																
30"	25 To Bed																
30"	26 From Bed																
10"	27 Lower Footrests On Wheelchair																
30"	28 Wheelchair To Standing																
30"	29 Standing To Wheelchair																
10"	30 Raising Footrests On Wheelchair																
15"	31 Going Forward 30 Feet																
15"	32 Going Backward 15 Feet																
10"	33 Complete Turn To Right																
10"	34 Complete Turn To Left																
30"	35 Pull Door Open, Go Thru & Close																
30"	36 Push Door Open, Go Thru & Close																
30"	37 To Standard Chair																
30"	38 From Standard Chair																
30"	39 On Toilet																
30"	40 Off Toilet																
30"	41 In bathtub Or Shower																
30"	42 Out Of Bathtub Or Shower																
10"	43 Over Doorsill																
10"	44 Over Carpet Or Rug																
30"	45 To Floor																
30"	46 From Floor																
1'	47 Into Automobile																
1'	48 Out Of Automobile																
2'	49 Management Of Wheelchair Into Auto																
2'	50 Management Of WC Out Of Auto																
1'	51 Pick Up 5 Lb. Pkg-Carry 10 Feet																
15"	52 Up Ramp, 4 Feet																
12"	53 Down Ramp																
5"	54 Ascending Curb																

NAME:



NEW YORK STATE REHABILITATION HOSPITAL, WEST HAVERSTRAW, NEW YORK
Department of Physical Medicine - Physical Rehabilitation Section

ST	FUNCTIONAL ACTIVITIES (con't.)	BED PT	BED P	BED I	BED T	WC PT	WC P	WC I	WC T	AMB WA PT	AMB WA P	AMB WA I	AMB WA T	AMB WOA PT	AMB WOA P	AMB WOA I	AMB WOA T
5"	55 Descending Curb																
30"	56 Up 3 Standard Steps With Handrail																
30"	57 Down 3 Steps With Handrail																
30"	58 Up 3 Standard Steps s̄ handrail																
30"	59 Down 3 Steps Without Handrail																
10"	60 Ascending Bus Steps																
10"	61 Descending Bus Steps																
4'	62 Move 300 Feet, Pavement																
12'	63 Move 880 Feet, Pavement																
20"	64 Move 30 Feet, Rough Terrain																
8'	65 Ambulate 440 Feet, Linoleum																
2'	66 Up and Down One Flight Of Stairs																
15'	67 In & Out, Theatre Seat (Aisle Seat)																
20"	68 In & Out, Theatre Seat (3 Seats In)																
20"	69 Crossing Street (48 Feet) On Signal																
30"	70 Ascending Train Steps																
30"	71 Descending Train Steps																
5'	72 Use Hands, Standing, Balance																
10Hr	73 Keeping braces On For 10 Hours																
	74 Drive Car (Appropriately Equipped																
4Hr	75 Independent Of WC For One-Half Day																
8Hr	76 Independent Of WC For A Full Day																

KEY TO GRADING

P	I	T	
○			Unable to perform the activity
⧄			Performs awkwardly or needs more practice
☒			Performs Activity Satisfactorily
	○		Unable to perform the activity without assistance
	⧄		Assistance necessary only for reasons of safety
	☒		Performs activity independently
		○	Requires more than twice the allotted time
		⧄	Requires not more than twice the allotted time
		☒	Able to do the activity within the allotted time
			Not tested
			Not applicable
○	○	○	Unable to perform activity
☒	☒	☒	Performance within normal limits

KEY TO SYMBOLS

ST - Standard Time
PT - Performance Time
P - Performance Rating
I - Independence Rating
T - Time Rating
WC - Wheelchair
AMB WA - Ambulation With Apparatus
AMB WOA- Ambulation Without Apparatus

SUMMARY BASED ON COMPLETE SUCCESS OR FAILURE

1. Total within normal plus not applicable				
2. Total failed plus not tested				
3. Number of items in classification	20	50	60	40
4. Percent within normal (divide #1 by #3				
5. Percent failed (divide #2 by #3				
6. Easier items untested in classification	0	8	40	60
7. % of normal functioning (#1 plus #6)				

SUMMARY BASED ON PARTIAL SUCCESS OR FAILURE (WEIGHTED SCORES)

Value Of Symbols In Completing Weighted Scores
☐ =0 ⊡ =0 ⧄ =1 ☒ =2 ⊟ =2

a. Sum of weighted scores				
b. Total weighted scores				
c. Maximum weighted scores	120	300	360	240
d. % of maximum (divide b. by c.)				
e. Value of easier items not tested	0	48	240	360
f. Sum of b. and e				
g. % of normal functioning (divide f. by c				

Date of Initial Test ______
Retest Date ______

NAME:

scores," add a number which gives credit for the weighted value of easier items not tested (for Bed add 0, for Wheelchair add 48, for Ambulation With Apparatus add 240, for Ambulation Without Apparatus add 360). Divide the resulting sum by six, and the number obtained represents the percentage of over-all functioning as measured by the test, in comparison with that of a physically normal person, giving credit for the patient's partial successes.

Interpretation of Results

While the description of the above procedures may sound involved at first reading, it should be pointed out that several methods of evaluation have been described. For the purposes of the therapist who is interested in what the patient can or cannot do, a summation may not be necessary. By inspection of the items the therapist can determine activities accomplished or failed, follow the patient's improvement, and note the degree of assistance required and whether or not the patient is slow in accomplishing specific activities. Since the physician generally desires a more general indication of the patient's degree of rehabilitation, the percentages described above have been presented. For a simple summation, the percentages dealing only with activities performed successfully within normal limits may be employed. For a more accurate picture, percentages based upon weighted scores, which include activities incompletely accomplished, is recommended. Lastly, by reference to percentages expressing comparisons between the patient and his own classification, and those showing his relation to a physically normal person ("Per cent of normal functioning") a better perspective of functional ability is obtained. With continued use of the test, it should become apparent what range of scores should be considered critical for characterizing a patient as bed, wheelchair, or ambulant. If a patient's score is regarded as exceptionally high or low for the particular classification in which he is tested, then he should be tested on the next higher or lower classification. What comprises a relatively "high" or "low" score can best be determined by further experience with the test and the judgment of the doctor and therapist.

The authors wish to thank Doctor Austin J. Canning, Director, New York State Rehabilitation Hospital, for his helpful encouragement in the development of the test and for his insistence that we write about this test

We are gratefully indebted to Miss Elaine Mulligan, Stenographer, Physical Rehabilitation Section, who gave willingly of her free time to typing the manuscript and rendering valuable stenographic assistance in many other ways

ARCHIVES of PHYSICAL MEDICINE

OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL MEDICINE

.·. EDITORIAL .·.

AMERICAN BOARD OF PHYSICAL MEDICINE AND REHABILITATION

The next examinations for the American Board of Physical Medicine and Rehabilitation will be held in Chicago, June 8 and 9, 1952. The final date for filing applications is March 31, 1952. Applications for eligibility to the examinations should be mailed to the Secretary, Dr. Robert L. Bennett. Georgia Warm Springs Foundation, Warm Springs, Georgia.

A TRAINING PROGRAM FOR REHABILITATION

The development of the concept of rehabilitation of the physically handicapped has produced a fundamental change in the practice of Physical Medicine. The field of activity has been extended from the application of physical therapy and occupational therapy to the hospitalized or clinic patient to a program involving medically supervised activity and training to restore the patient to maximal social and vocational independence. Of necessity this broadened scope of rehabilitation will require the training of a number of types of rehabilitation workers. If rehabilitation is to be successful, these rehabilitation workers must be trained adequately to work with the physically disabled throughout the entire range of rehabilitation. In some areas of the rehabilitation program, the present training has been adequate. Other phases of the program are in the developmental stage and there have been no adequate training courses for them. The greatest deficiencies in the rehabilitation program are the gaps existing between the various therapies. As rehabilitation moves from a demonstration stage in a few large centers to general use throughout the country, it is essential that the physiatrists examine the training programs for professional workers in the field of rehabilitation to assure that adequate standards of education and adequate and efficient coverage of all phases of rehabilitation be established.

At the present time, we have physical therapists, occupational therapists, social workers, vocational counselors, and vocational teachers officially in the rehabilitation program. Where there are deficiencies in our present programs, other groups are clamoring for admission as separate specialties in rehabilitation. Of necessity, all of these groups will need medical supervision. All specialist groups need to have their training qualifications and their therapeutic contribution evaluated to assure that complete and efficient rehabilitation is provided. The basic concept of rehabilitation is the recognition of the disabled patient as an individual who has a number of potential abilities which should be developed maximally to restore him to the greatest possible physical, mental, social and vocational usefulness. In order that each of the professional groups have an understanding of this total concept of rehabilitation, it is important that rehabilitation workers in all phases of the program be trained in the basis for rehabilitation, in the potential abilities of the human body and in the basic problems to be solved by the rehabilitation process.

In this issue, Arestad's article deals with the present standards of training for occupational and physical therapists. These standards of training have been established over many years to meet the demands of hospital and clinical occupational and physical therapy. These training programs should be reviewed in the light of our present needs in rehabilitation. We face two problems in establishing standards: first, to assure that the professional personnel have an adequate education to deal with physically handicapped persons; second, to make sure that the training programs do not become so involved and long that we cannot supply an adequate number of workers to carry on rehabilitation. The solution of these two problems will require careful scrutiny of the entire curriculum required of the various rehabilitation specialists and maximal efficiency in the use of the training time. Two other articles in this issue point to the need for extension of training into the field of care of the geriatric patient and in the development of the necessary daily activities by the physically handicapped.

Since this is a total medical program, it is essential that all professional persons in rehabilitation have a basic training in medical sciences in order to understand the potentialities of the disabled patients. This should include adequate training in human anatomy, with emphasis on the neuromuscular system and kinesiology. The physiological responses of the nervous and muscular systems should be taught, together with their application in the development of control, coordination, power, endurance, and speed. Since there is no general agreement on the best physiological mechanism for developing muscle coordination through therapeutic exercise, it is essential that workers in this field have an adequate background in physiology so that they can understand the various concepts of therapeutic activity proposed for clinical use. All workers in the field of rehabilitation need a basic understanding of the various disease processes which cause physical disability. This includes the pathology and the clinical pathology in the fields of internal medicine, neurology, surgery, orthopedics, and pediatrics as they apply to the physically disabled. These courses should be made a common requirement for all rehabilitation workers. It has been proposed that a basic science examination covering these basic medical concepts be given to all rehabilitation workers in addition to the examination on the particular specialty. This would insure that all workers in rehabilitation would have a fundamental understanding of the subject.

The other fundamental problem to be solved in our training program for rehabilitation is to assure that the specialties in rehabilitation be broad enough so that there are no gaps in the training program. A very practical consideration in planning for rehabilitation on a community basis throughout the country is the recognition that in smaller centers only a limited number of persons can be employed. Therefore, these workers must have adequate training so that they can supervise a relatively broad area of rehabilitation. It is only in the extremely large centers that it will be possible to have specialists concentrating on narrow areas of the field. The apparent lack of an adequately broad training program in rehabilitation has led to the development of new groups who wish to become recognized therapeutic specialists in this field. Corrective therapy was developed in the army to emphasize therapeutic exercise at the heavy resistance, high endurance, group activity level. The essential qualifications for corrective therapists and physical therapists are the same and in small rehabilitation programs it is uneconomic to duplicate personnel with an arbitrary division of activity. The reasonable answer would appear to be the extension of the training of the corrective therapists to include the other techniques of physical therapy and the extension of the courses in therapeutic exercise for the physical therapists to cover the endurance and group activities which are necessary in a complete rehabilitation program. Likewise, recreation workers, manual arts therapists, drama therapists, music therapists, and art therapists all have attempted to establish themselves as specialists in the general field of occupational therapy. While it may be possible to hire these specialists in very large institutions, in the smaller rehabilitation centers it will be necessary to have versatile therapists who can supervise a broader area of activity. This means that the occupational therapist, as the basic professional person working in this area of rehabilitation, must have adequate training to be able to supervise all of these activities. A large gap which at present does not appear to be filled is the prevocational training which must develop as an extension of the activities of occupational therapy designed to provide the patient with the necessary skills to prepare him for vocational education. Development of this program requires considerable thought and effort. Finally, in the area of vocational counseling, the training program must be enlarged to make sure that counselors have a concept of the potentialities of the physically disabled and the problems involved in adjusting the physically disabled person to industry. There is a great difference between the counseling and testing of the physically normal individual for vocational placement and the counseling and testing of the physically handicapped individual for vocational placement. Vocational counselors must have a thorough understanding of these problems and potentialities if placement is going to be satisfactory.

The goal of such a training program is the development of teams of professional workers who have a similar background of understanding of the potentialities, the possibilities and problems of the physically handicapped individual. These teams of workers must be able to carry on rehabilitation in all of its phases, from the acute hospital stage until the patient is placed on the job. Such a team forms the basic unit for the establishment of a rehabilitation center and must be able to handle all phases of rehabilitation that the situation demands. Obviously, the team may be expanded and specialists included if the rehabilitation center is large. However, for complete rehabilitation, each center must have this basic team. Recognizing the fact that the entire team is essential in the rehabilitation program and that many centers will be relatively small, we must have a team of not more than four specialties in addition to the physician if small units are to be practical. It is necessary, therefore, that we plan the training programs so that existing specialties are broadened to cover the entire field of rehabilitation. This must be done without increasing the time for training, which is not a simple task. However, with planning it can be done. The general establishment of rehabilitation programs will not be possible until such a unified training program is available.

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MEDICAL NEWS

Members are invited to send to this office items of news of general interest, for example, those relating to society activities, new hospitals, education, etc. Programs should be received at least three weeks before the date of meeting.

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Inexpensive Accommodations for 1952 International Congress

Dr. A. C. Boyle, Hon. Secretary of the International Congress of Physical Medicine has informed The American Congress of Physical Medicine of special hostel arrangements for members of the Congress who wish to attend the meeting in London, July 14-15, 1952. Dr. Boyle writes:

The fee for one room, either single or double, is five guiness per head per week which includes dinner, bed and breakfast, with lunch on Saturday and Sunday. Applications for less than one week cannot be accepted, and for additional days the charge is 17/6 per day and 21/— per day at the week-end with breakfast and lunch as well as dinner. Members who wish to apply for this accommodation should send a reservation fee of 1½ guineas with their application.

I would be most grateful if notice of these facilities could be made known to the members of your Society, so that they may apply to me as soon as possible. Bookings may be quite heavy and, as you will appreciate, we must know some time in advance how many delegates require this accommodation in order to make a firm contract with the Hostel.

Reservations may be made by addressing Dr. Boyle at 45 Lincoln Fields, London, W. C. 2. As of Jan. 12, 1952, the rate of exchange on the British pound is 2.79.

Society of Physical Medicine (Toronto)

A Society of Physical Medicine has been formed in Toronto, Ontario. The present membership comprises fifteen physicians who are practicing Physical Medicine in the Toronto area and who, variously, are associated with The Workmen's Compensation Board, Department of Veterans' Affairs, General Hospitals and an Institution for the treatment of paraplegics.

At the inaugural meeting on October 24th, 1951, under the Chairmanship of Dr. A. Zinovieff, a program of activities for session 1951-1952 was arranged. Dr. J. Berkeley was appointed Secretary.

The Society has already met at Sunnybrook Hospital on November 21st, 1951, for a symposium discussion on lesions of the intervertebral disc. Dr. R. Lawson was Chairman and the main speakers were Dr. Ian McNab and Dr. H. Cranfield. On January 16th, 1952, a meeting was held at St. Michael's Hospital in Toronto, under the Chairmanship of Dr. Macrae and on March 19th, 1952, at The Workmen's Compensation Board, Convalescent Center, Malton, a meeting will be held under the Chairmanship of Dr. B. H. Young.

At the present time, efforts are being made to contact physicians throughout Canada who are practicing physical medicine, with a view to the formation of a Canadian Association of Physical Medicine. It is planned to maintain liaison with such physicians by forwarding them copies of the proceedings of the meetings held by the Toronto Society. Interested physicians or organizations in Canada who have not yet been contacted are invited to get in touch with Dr. Joseph Berkeley, Secretary, Society of Physical Medicine (Toronto), % The Workmen's Compensation Board, Convalescent Center, Malton, Ontario.

Films on Rehab and OT Media

From the Office of Vocational Rehabilitation, Federal Security Agency, Washington 25, D. C., comes a new 16mm color, sound film entitled, "An Investment in Human Welfare" presenting a dramatic picture of how the physically handicapped are successfully employed and how well they have met their job demands . . . Also new is a 16mm color, sound film, "Functional Anatomy of the Hand," prepared by the National Foundation for Infantile Paralys's in cooperation with the Department of Anatomy, Duke University, School of Medicine, showing normal function of hand and forearm. For further information write to Medical Department, Division of Professional Education at the National Foundation headquarters located at 120 Broadway, NYC 5.

Kessler Institute for Rehabilitation to Hold Sixth Annual Amputee Conference

The Sixth Annual Amputee Conference will be held at the Kessler Institute for Rehabilitation, Pleasant Valley Way, West Orange, New Jersey, on May 1, 2, 3, 1952. Included in the conference will be a clinic for congenital amputee children scheduled for Saturday, May 3.

The conference will feature lectures by staff members of the Kessler Institute and visiting lecturers, in addition to instructional films and demonstrations by patients of amputee training techniques.

The conference will discuss the problems of upper and lower extremity amputees. The subjects will include psychological preparation of the patient, surgery for upper and lower extremity amputations, aftercare of the stump and general conditioning, prostheses, and training of the amputee.

Registration is open to physicians, therapists, nurses and counselors in the rehabilitation professions. Persons desiring to register should communicate with the Kessler Institute, Pleasant Valley Way, West Orange, New Jersey. For the first time, the Kessler Institute will issue certificates to all registrants who attend the full three-day conference.

Further details of the program will be made known as plans are completed.

Pennsylvania Academy Meeting

At the January meeting of the Pennsylvania Academy of Physical Medicine and Rehabilitation, Dr. George M. Piersol conducted the scientific program. The following papers were presented: "Physiological Phenomena of Interest in Physical Medicine," by Dr. Herbert Shapiro: "Principals Involved in a Comparative Evaluation of Various Forms of Diathermy," by Drs. H. P. Schwan and E. L. Carstensen.

Grant Awarded for Research on Multiple Sclerosis

The sum of $39,744 has been awarded to the Harvard Medical School and Massachusetts General Hospital, Boston, Mass., by the National Multiple Sclerosis Society. A research clinic will be established at the hospital for diagnosis, treatment and study of patients with multiple sclerosis.

Scientific Exhibit, A. M. A. Chicago Session

Mr. Howard A. Carter will be in charge of an exhibit symposium on noise and health.

The Section on Physical Medicine and Rehabilitation, cooperating with the American National Red Cross, the Council on Physical Medicine and Rehabilitation and various other agencies, will present an exhibit on the essential features of artificial respiration.

New York Society of Physical Medicine Meets

At the February 6, 1952, meeting of the New York Society of Physical Medicine, the following topics were presented: "The Body Image and Its Role in Rehabilitation," by Earl C. Chesher, M.D., and "Restitution of Function Following Cerebral Lesions," by Hans Lukas Teuber, Ph.D.

Illinois Chapter to Aid Indigent Arthritic Patients

The Illinois Chapter of the Arthritis and Rheumatism Foundation recently announced that a portion of the funds raised in Chicago will be used for giving medical and financial aid to indigent victims of arthritis and rheumatism in Chicago. The chapter has established 11 clinics in the city and each applicant will be placed under the care of a team consisting of a physician, therapist, rheumatologist, orthopedist, medical social worker and nurse.

Personals

Dr. **Gerald Hirschberg** addressed the New Jersey Society of Physical Medicine at its January meeting. His topic was "Diagnostic Electromyography."

At the 12th Annual Congress on Industrial Health, held at the Hotel William Penn, Pittsburgh, January 18 and 19, 1952, the following topics were presented: "Industrial Health Is Industrial Strength," by **Howard A. Rusk**, M.D., and "The Orthopedically Disabled Person," by **Edith L. Kristeller**, M.D.

Dr. **Y. T. Oester**, Chicago, is a member of the Organizing Committee of the Chicago chapter of the Walter Reed Society. The organization is composed of persons who have voluntarily served as test subjects or "guinea pigs" in research projects directed by qualified scientists.

Dr. **H. Worley Kendell** has been appointed a member of the National Advisory Neurological Diseases and Blindness Council, Public Health Service. There are twelve members on the council whose function is to advise the Surgeon General on Public Health Service activities which fall within its area of interest, keeping him informed of research activities and health problems of the Nation.

Dr. **Louis N. Rudin**, Fort Howard, Maryland, has been appointed Editor for Physical Medicine of the Current Medical Digest, published by The Williams & Wilkins Co.

William E. Mendenhall

It is with regret that we announce the death of Dr. William E. Mendenhall of Indianapolis, Indiana. Dr. Mendenhall was a Congress member of long standing.

Franz M. Groedel

It is with regret that we announce the death of Dr. Franz M. Groedel of New York City. Dr. Groedel has been a member of the Congress for many years.

Joshua M. Lee

It is with regret that we announce the death on November 30, 1951, of Dr. Joshua M. Lee of Denver, Colorado. Dr. Lee died of coronary thrombosis. He was a Congress member for many years.

BOOK REVIEWS

PIONEER DOCTOR. By *Lewis J. Moorman*, M.D. Cloth. Price, $3.75. Pp. 252. University of Oklahoma Press, Norman, Okla.

This pleasantly readable book will probably have more appeal to those associated with the medical profession but will tell an interesting story to the lay reader as well. The vast changes which have occurred in medicine during the past fifty years are here recounted by an individual who lived through them as they came about and adjusted to them accordingly — from the days of the doctors who attended patients for all their sundry ailments to the present day of specialization. Possibly the next fifty years may result in similar giant strides but here for your pleasure is an account of fifty years ago to the present told in an entertaining, smooth-moving way with amusing and pathetic anecdotes.

THE DISPENSATORY OF THE UNITED STATES OF AMERICA: 1950 EDITION. By *Arthur Osol*, Ph.G., M.S., Ph.D., Professor of Chemistry and Director of Department of Chemistry, Philadelphia College of Pharmacy and Science, Philadelphia; *George E. Farrar, Jr.*, M.D., F.A.C.P., Associate Professor of Medicine, School of Medicine, Temple University, Philadelphia, and others. Advisory Editor: *Horatio C. Wood, Jr.*, M.D., Ph.M., Professor of Pharmacology, Philadelphia College of Pharmacy and Science, Philadelphia. Volume I, Parts 1-5: Based on thirteenth revision of United States Pharmacopoeia, National Formulary, eighth edition, and British Pharmacopoeia, 1932, and its addenda. Twenty-fourth edition, 1947. Volume 2, Parts 6-7: Being commentary on new drugs introduced in fourteenth revision of United States Pharmacopoeia, National Formulary, ninth edition, British Pharmacopoeia, 1948, as well as new drugs not officially recognized. 1950 edition. (In one volume.) Cloth. Price, $25.00. Pp. 2057. J. B. Lippincott Company, 227-231 S. 6th St., Philadelphia 5; Aldine House, 10-13 Bedford St., London, W.C.2; 2083 Guy St., Montreal, 1947; 1950.

The present volume is a commentary on the new drugs introduced in the fourteenth revision of The United States Pharmacopoeia, the ninth edition of The National Formulary, and the 1948 edition of The British Pharmacopoeia, as well as other new drugs not officially recognized. Aside from its obvious practical usefulness to the physician, it makes interesting reading because every page affords a new insight into the apparently inexhaustible resources of modern chemistry. There are descriptions of eighteen new antihistaminic drugs, new hormones like cortisone, new antibiotics, and oddities like tetraethylpyrophosphate, which is at once a miotic and a pesticide and lies in the twilight zone between organic and inorganic chemistry. For each drug the authors give all the information that might be needed by the prescriber, including actions, side-effects to be watched for, dosages, vehicles, incompatibilities, and other warnings. A few familiar items, such as boric acid ointment and ammoniated mercury ointment, appear because of the recent substitution of liquid petrolatum and white ointment for the wool fat formerly used. The book can be recommended without reservation as being at once instructive and useful.

DIABETES CONTROL. By *Edward L. Bortz*, M.D., Chief of Medical Service B, The Lankenau Hospital; Associate Professor of Medicine, Graduate School of Medicine, University of Pennsylvania, Philadelphia, Former President of the American Medical Association. Cloth. Price, $3.50. Pp. 264 with illustrations. Lea & Febiger, Washington Square, Philadelphia 6, 1951.

This textbook entitled "Diabetes Control" by Dr. Edward L. Bortz has been prepared especially as a guide for diabetic patients. The text is well planned, easily understandable and should prove of particular value to any interested diabetic. The present concepts of the disease are discussed including detection, control, diagnosis and treatment of diabetes. Individual chapters cover adequately the subjects of pregnancy and diabetes, surgery and diabetes, meal planning and diabetic coma. Particularly notable and surely of interest to patients is the chapter on Answers and Questions regarding diabetes. The author discusses all forms of insulin now in use, including NPH insulin. The text is adequately illustrated and is recommended for use by diabetic patients.

DISEASES OF THE TROPICS. By *George Cheever Shattuck*, M.D., Professor of Tropical Medicine, Harvard Medical School and Harvard School of Public Health, Emeritus; Consultant for Tropical Diseases, Boston City Hospital and Massachusetts General Hospital. Cloth. Price, $10.00. Pp. 803 with illustrations. Appleton-Century-Crofts, Inc., 35 West 32nd Street, New York 1, 1951.

This textbook of Diseases of the Tropics is particularly well suited for use by the general practitioners, specialists and students. This is especially true at this time when the prevalence of tropical diseases is not confined solely to the tropics but is seen not infrequently in the returning veteran. In this regard both malaria and amebiasis are especially notable. The text is divided into twelve parts and covers the field of tropical diseases in a very well arranged and easily readable manner. The discussion of the more important diseases such as malaria, amebiasis, the typhus fevers, leishmaniasis and others is adequate. In like manner diseases of lesser importance have been treated accordingly in more brief expositions. The public health aspects of each disease are covered and include epidemiology, prevention and control. Diagnostic measures as well as more recent treatment methods are included. The text is adequately illustrated and both the chapter references and the general index are particularly notable. The publishing is good and the book can be recommended to all physicians.

VITAMIN METHODS: Vol. II. Edited by *Paul Gyorgy,* School of Medicine, University of Pennsylvania, Academic Press, Inc., 125 East 23rd Street, New York 10, New York. XI, 740 pp. 16.3, 23.5 cm. Price, $14.50.

This volume covers the field of laboratory techniques with small animals in a systematic and detailed manner and is a valuable adjunct to Volume I which covers the physical, chemical and microbiological methods of vitamin assay. It does in fact, contain a three chapter supplement to Volume I in which are compiled many of the more recent developments in vitamin work in these fields.

The five chapters which make up Volume II treat the several aspects of vitamin research as follows: Chapter I "General Aspects of Small Animal Experimentation" by N. B. Cuerrant, gives specific details on care of and experimentation with laboratory animals and is especially useful to people who have had no experience with animal work. "The Animal Vitamin Assays" is Chapter II and is written by C. I. Bliss and Paul Gyorgy. Chapter III by James Hazlitt Jones. It describes "Laboratary Diagnosis of Human Vitamin Deficiencies." Chemical signs of malnutrition are outlined and described in Chapter IV by Norman Jolliffe and as Editor Gyorgy points out in the preface this chapter should be especially valuable to physicians. Chapter V, "Statistical Methods in Vitamin Research" by C. I. Bliss gives a comprehensive and understandable discussion of statistical methods which is applicable to fields other than vitamin research.

Each chapter is preceded by a detailed table of contents and followed by a complete list of references, which greatly facilitates the use of the book as a reference. The generous use of pictures, tables and diagrams accentuates the well organized presentation of the information contained therein.

PHYSIKALISCH - DIÄTETISCHE THERAPIE. NACH KLINISCHEN GESICHTSPUNKTEN. (Physical-Dietetic Therapy. From a Clinical Point of View.) By *Dr. Hans-Georg Scholtz,* Berlin. Georg Thieme, Leipzig, 1950, $18.50.

Physical-dietetic treatment measures have had their ups and downs in the history of medicine, but the author believes that physical-dietetic therapy has found a definite place in modern medicine. He states that many physiological effects of physical-dietetic treatments have been very satisfactory, although at present they cannot be explained on the basis of our knowledge in physiology. Possibly the vegetative nervous system plays an important role in producing these effects. There exists for example an important relationship between the function of organs and the entire psychic reaction on the one hand and the changes in functions of the skin on the other. It is probable that proper use of such relationships may increase the beneficial effects of therapeutic agents.

For these reasons the author feels that the material presented in his book must emanate from the clinic and not from the laboratory. He suggests discussion of the physiological effects of physical-dietetic measures only to the extent that they are necessary to understand the clinical aspect. The correct prescription for these measures depends to a large extent upon the experience of the attending physician and to a smaller degree upon the functional diagnosis and also upon the type of constitution of the patient. In physical-dietetic therapy the best results are obtained with properly prescribed measures, careful technical procedure and proper diet.

The book is divided into two main parts: a section on methods and uses of physical therapy measures and their physiological effects, and a clinical section. The first section describes hydrotherapy, balneotherapy, light therapy, electrotherapy, high frequency therapy, ultrasound therapy, massage and exercise and climatic therapy. This first section is followed by a twenty-page chapter on the basis of the diets for patients. The second (clinical) division describes measures to be taken for various diseases such as infections, circulatory disturbances, diseases of the respiratory system, stomach and intestines, liver, gall bladder, kidney, nerves, et cetera. All measures described combine routine physical treatment, techniques—therapeutic combined with proper dietetic procedures. The book is well written and illustrated.

* * *

PHYSICAL MEDICINE ABSTRACTS

Heavy-Resistance Exercises: The "Oxford Technique." A. N. Zinovieff.

Brit. J. Phys. Med. 14:129 (June) 1951.

DeLorme described a system of "heavy resistance-low repetition exercises" to build up power and volume in various muscles, but with particular reference to the quadriceps, as opposed to "low resistance-high repetition exercises" to develop endurance. DeLorme's method was given a trial at the Department of Rehabilitation and Physiotherapy, United Oxford Hospital, but consistent difficulties were encountered. At each session of exercise, while building up to the 10 R. M., the quadriceps became so fatigued that the last quarter of the session became very exhausting to the patient. In addition, the quality of performance fell off to such an extent that full active extension of the knee was by then rarely possible, thus detracting from the value of the session and preventing the performance of the exact technique.

The principle of "heavy resistance-low repetition" seemed to have so much to recommend it that it was considered that it should be retained. However, after some consideration, it was decided to reverse the procedure, in order to make it a more physiological method of exercise and yet retain this principle. In other words, after a brief period of warming up the muscle by quadriceps drill and anti-gravity contractions, the exercise period was begun with the 10 R. M., and then the weight was reduced at the end of each group of 10 lifts, 100 lifts constituting a session. In this way it was believed that the fall in resistance could be made to approximate to the fatigue in the muscle, and yet, in each group of 10 lifts, the muscle would be exercised to its maximum of capacity. Obviously, there are many practical difficulties in estimating the rate of fatigue in different individuals, and thus assessing the amount of weight that should, theoretically, be discarded after each group of lifts. It was found after trial, however, that for the quadriceps a reduction of one pound after each group of lifts was a satisfactory average, and this was adopted. In order to maintain rapid progression, the patient attempted to increase his 10 R. M. by one pound each day, and if he was successful the new 10 R. M. was used as the starting point for the next day's exercise session. If not, no further increase was attempted on successive days until this figure had been achieved. When the 10 R. M. was less than 10 pounds, a proportion of 20 repetitions was included, so as to maintain the lowest weight used as that of the limb plus the weight-holder (4 pounds). In 55 consecutive out-patient cases with wasted and weak quadriceps muscles, careful records were kept to observe the efficacy of this technique in developing power and volume. Particular attention was paid to complaints of pain on doing these exercises and to the state of effusion, if any. These patients had no other physical therapy than the once-daily session of heavy-resistance exercises 5 days a week. They represented a cross-section of the average type of cases that are treated by the accident service of a big general hospital. Included were cases of traumatic synovitis and rotation strain of the knee, ligaments and cartilage tears of the knee, post-meniscectomies, fractured femora, fractured tibiae, and so forth. The series was not considered to be large enough for detailed case analysis. Exercises, carried out in the fashion described, resulted in an average volume increase of ⅜ inch every two and one-half weeks. The 10 R. M. increased at just over one pound a day (7 pounds in 5 days), and the absolute power (measured by a single spring lift) increased by 10 pounds a week. An average of just over 2 weeks' treatment was required before discharge with normal or nearly normal power (within 10 pounds S. S. L. of normal quadriceps). The Oxford Technique, while retaining the principle of heavy resistance-low repetition, yet allows a longer period of daily exercise, with less strain on the patient or on the patients' knee. For out-patients who are working, it provides a method of developing volume and power in wasted and weak muscles, which takes only about half an hour 5 days a week. If the criteria for selection of cases are strictly adhered to, neither difficulties nor complications are experienced. It is important to note, however, that attention to detail in performing the exercise is very important in obtaining the best results, and that the daily session must be supervised by a physical therapist or remedial gymnast. As with DeLorme's technique, it has been successfully adopted for use in muscles other than the quadriceps.

Surgical Aspects of Anklyosing Spondylitis. W. Alexander Law.

Brit. J. Phys. Med 14:171 (Aug.) 1951.

Treatment falls under two headings: conservative and operative, though in actual practice they are very closely related, and the team of physician, orthopedic surgeon and physical therapist should always be at hand. The objects of conservative treatment are (1)alleviation of pain; (2) prevention and correction of deformity; and (3) maintenance and restoration of muscle tone and power, with resulting improvement in function. Pain is best controlled by the old surgical principle of rest. Immobilization of the affected joints and correction of deformity must be combined with, and followed by, an active exercise program for the various muscle groups in order to maintain their power, tone and elasticity. In this respect respiratory exercises are very important, both for the purpose of maintaining some intercostal movement, and helping in expanding the chest and thereby counteracting the spinal deformity. Progress can be checked by recording the chest expansion at regular intervals. All forms of physical therapy are useful in these cases: Massage and heat, either superficial or deep, to soothe the muscles and encourage the blood flow through them; faradism to maintain tone and power; pool therapy for joint movement and muscle coordination. This more active phase of conservative treatment should be instituted as soon as possible, but is useless in the presence of pain with its accompanying muscle spasm, or a rising blood sedimentation rate indicating an active disease process.

A Positive Approach to Management of Cerebro-Vascular Accident. Louis Feldman.

Geriatrics 6:214 (July-Aug.) 1951.

Apoplexy from cerebral hemorrhage is nearly always caused by hypertension, and usually occurs in people past 45 with associated arterial degeneration. Thrombosis nearly always develops in older persons with generalized arteriosclerosis. Cerebral embolism may occur at any age, and usually is secondary to valvular endocarditis, abscess of the lung, or incidental to the course of auricular fibrillation and cardiac failure. The treatment must take into consideration not only the anatomical and functional lesions but also the personality of the patient. For the sake of clarity the treatment may be divided into that of the acute or emergency stage and that of the rehabilitation or convalescent period. In the case of a cerebral vascular accident, the internist, neurosurgeon and physiatrist are called in and plans are laid for the immediate and long-term care of the patient. The fields of treatment of the three tend not to overlap or contrast and may complement each other to the patient's benefit. In planning physical therapy and rehabilitation measures, the patient's general condition and cardiovascular tolerance must always be kept in mind. Blood-pressure and pulse readings should be taken on all patients before and after physical therapy measures have been carried out. As soon as possible a skeletomuscular functional evaluation test should be made, including a careful psychological and psychiatric check-up. These tests are repeated at intervals during the course of treatment and accurate records kept. A patient who has severe brain damage so that he does not understand orders given him, or who has a defective memory or is unable to concentrate, is a poor subject for rehabilitation. It also has been observed that the lower extremity recovers sooner than the upper one. It has been suggested that only those cases be selected for rehabilitation which are considered susceptible to improvement. Patients suffering from malignant hypertension, encephalomalacia or advanced senility should certainly not be included in such programs, since the results always will be disappointing. A trial period of supervised activity must precede any rehabilitative measures in hypertension. Where hemorrhage was the underlying factor, much caution is required. Exercises must be carried out in bed only, after the first two or three weeks; then gradually the patient may be taught to sit up in bed and start other procedures.

Certain contractile currents, notably the slow sinusoidal current with 20 to 40 contractions per minute, have proven valuable in the early stages of rehabilitation to stimulate contraction of flaccid muscles and keep up muscle tone and trophism of joints and surrounding tissues. These treatments, given for almost 15 minutes daily with a strong enough contraction to produce tension on the involved muscles, are continued until voluntary active motion returns. In many cases it has helped the reeducation of muscle function and has retarded muscular atrophy.

The patient's limbs should be put through relaxed or passive movements by a trained individual several times a day to the limit of muscular strength and joint range. Later active assistive and resistive exercises are added. Suspension-pulley therapy, which may be instituted while the patient is still in bed, will encourage movement of the arm or leg on the affected side and will assist in the reeducation of reciprocal motion fundamental to walking. Deltoid muscle setting, together with the pulley exercises, helps prevent so-called "frozen shoulder." As the arm becomes more freely movable, pain decreases. This procedure should be carried out for at least 15 minutes three times daily. Also indicated is a short period of bed strengthening-exercises, such as sitting on the edge of the bed and later standing beside it. Ambulation may be started by having the patient stand between two sturdy chairs placed back to back beside the bed. He is told to grasp the back of one chair with the good hand and the other one with the affected hand. It may be necessary to begin with to tie the affected hand to the chair with a bandage or to make use of a canvas mitt with straps that can be fastened to the apparatus. To reestablish reciprocal motion, the right foot is advanced as the patient pushes the left chair forward, and as the left foot is advanced the right chair is pushed forward. At the same time he is given arm-swinging exercises. As he progresses, walkers or parallel bars are used to retrain him further in standing and walking. Modified Frankel exercises have proved valuable for coordination. All efforts are directed toward inducing self-sufficiency and independence. If at the end of 9 to 12 months of intensive treatment, certain groups of muscles have shown no return in function, or if certain contractures persist, corrective surgical procedures should be tried. An attempt is made to rehabilitate the patient so that he may resume his original occupation or be taught a new one, or at least make himself independent in his daily personal activities.

Thrombophlebitis. Jack T. Rush, and James H. Forsee.

U. S. Armed Forces M. J. 2:1169 (Aug.) 1951.

Ninety-nine patients with acute thrombophlebitis occurring in 42,939 admissions were treated with anticoagulants between January 1, 1947, and December 31, 1949. The results were satisfactory in 97 patients; 2 required inferior vena cava or right common iliac vein ligation to prevent further pulmonary emboli. One 74-year-old patient died of pulmonary emboli, suddenly and without having received antocoagulant therapy following appendectomy. Penicillin is used in the presence of cellulitis. Lumbar sympathetic nerve block has been especially beneficial in relieving arteriospasm. Short wave diathermy is of value in treating the postphlebitis fibrositis. The occurrence of pulmonary emboli can be minimized by meticulous pre- and postoperative care. Patients with pulmonary emboli require immediate therapy. Postphlebitic venostasis has been treated with good symptomatic results by superficial femoral vein ligation, combined when indicated with lumbar sympathectomy.

Teamwork in the Rheumatic Diseases. A. G. Timbrell Fisher.

Brit. J. Phys. Med. 14:169 (Aug.) 1951.

The need for the closest cooperation between the physician, whether consultant or general practitioner in charge of the rheumatic patient, and other members of the team such as the orthopedic specialist, the physical therapist, the biochemist, bacteriologist, psychologist and others too numerous to mention, is, as most people are now aware, of vital importance. The physical therapist is one of the most important members of the team, and this fact is now almost universally admitted. The closest cooperation between the physician or orthopedic specialist who prescribes physical treatment and those who administer it is extremely important. In orthopedic cases Fisher has found that it greatly increases keenness and efficiency if the physical therapist is present at any orthopedic operation upon a patient who has previously been under her care and if the principles of any after-treatment are explained. This particularly applies to manipulative operations. In those hospitals where there is a practitioner of physical medicine, similar full and frank discussion is desirable. Physical treatment is not only of immense value, either before or after orthopedic operations. but invaluable as a concomitant to "medical" treatment. Wasting and deformity are not so dramatic in the chronic ambulatory patient as in the acute patient, but they undoubtedly occur, often very insidiously, and with very few exceptions the help of the department of physical therapy always should be sought. There are very few cases where such treatment is not of definite value, enhancing the results of purely medical treatment. It is necessary to emphasize these points strongly because one not infrequently sees patients who have been treated for long periods by purely "medical" treatments—drugs, vaccines, and so forth—and whose condition could have been greatly bettered if physical therapy had been given simultaneously.

Hypoventilation Syndrome in Bulbar Poliomyelitis. Stanley J. Sarnoff; James L. Whittenberger, and John E. Affeldt.

J. A. M. A. 147:30 (Sept.) 1951.

Because of the complex nature of respiratory inadequacy due to bulbar poliomyelitis and the severity of associated disturbances in acutely ill patients with this disease, there is little precise knowledge of the disturbed respiratory mechanism itself. In a patient whose muscles of respiration do not coordinate and whose respiratory air flow pattern is grossly irregular, it is sometimes difficult to tell whether the irregularity is caused by involvement of the respiratory center or by the airway difficulties engendered by cranial nerve involvement. It is suggested that this results from an altered sensitivity of the respiratory center to carbon dioxide consequent to medullary involvement in this disease. Verbal artificial respiration can be effectively administered under these circumstances if the patient is responsive and is observed continuously by competent personnel, and if it is not required for too prolonged a period. This type of respiratory defect may occur more frequently than supposed, but may be masked by the more obvious abnormalities of breathing in bulbar poliomyelitis. The possible hazards of oxygen administration under these conditions have been mentioned. These potential hazards would, however, be readily overcome if any significant diminution of spontaneous ventilation is reversed by some means of artificial respiration. Electrophrenic respiration may be of help under circumstances where spontaneous respiration is inadequate or becomes so following the administration of oxygen. It is obvious that at least one phrenic nerve must be uninvolved by the disease if electrophrenic respiration is to be used.

Chronic Arthritis of Senescence. Russell L. Cecil.

Geriatrics 6:179 (May-June) 1951.

Senescence inevitably brings with it various ailments and disabilities, one of the commonest of which is some form of arthritis or rheumatism. These forms are discussed as to their effect on the aging patient. Physical therapy is recommended as an adjunct in the treatment of these conditions.

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ORIGINAL ARTICLES

The Role of Vocational Adjustment in Rehabilitation. Everill W. Fowlks, M.D.; Albert L. Cooper, M.D., and L. Kenneth Shumaker, M.A. 137
Discussed by Dr. Richard T. Smith.

Use of Painting in Rehabilitation of Tuberculous Patients. A. Ray Dawson, M.D. 147
Discussed by Dr. Florence I. Mahoney, and Dr. Dawson.

Ischemic Necrosis of the Anterior Tibial Muscle. Raoul C. Psaki, Lt. Col., MC, and Charles D. Schields, Lt. Col., MC 153

Adapted Wheelchair for Above-Knee Amputees. Carl M. Akwa, M.D.; Ray Piaskoski, M.D.; Edwin C. Welsh, M.D., and Leslie M. Root 156

A Device to Facilitate Standing From a Sitting Position: For Patients With Severe Residuals of Poliomyelitis. Leslie Blau, M.D.; Joseph Phillips, B.P.E., and Donald L. Rose, M.D. 159

●

Editorials 163

●

Medical News 166

●

Book Reviews 167

●

Physical Medicine Abstracts 169

●

Directory, Members, American Congress of Physical Medicine 173

●

EDITOR OF THE MONTH

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THE ROLE OF VOCATIONAL ADJUSTMENT IN REHABILITATION [*] [†]

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Introduction

The purpose of this paper is to delimit and describe the work of the hospital vocational adviser rather than to discuss the general nature of all the rehabilitation services. Since the psychological study of the patients is essential, a word on this subject must be inserted here. Psychology itself is one of the oldest and yet one of the newest of the so-called social sciences; yet it is even today attempting to find itself among the sciences and professions. Those who are familiar with "The American Psychologist" and its issues over the last five years will be well aware of the contemporary efforts to define various specialties within the field of psychology. Suffice it to say for our purposes that the differentiation between psychology and demonology is 125 or 150 years old and that the tools with which the psychologist works have undergone considerable refinement, especially during the last 30 years. The ancestors of modern psychology were concerned with what today is known as abnormal psychology. From the medical point of view there has at times been a great deal of action based on preconceived ideas of what mental disorders were. The field of psychiatry is supreme, in our thinking, in the field of abnormal psychology. From the point of view of society itself, nevertheless, and especially the law, a kind of "legal psychology" developed in which the judge has attempted to define a person "legally sane" regardless of other considerations. It is only since the beginning of the twentieth century and possibly since the development of the mental hygiene movement that a new phase has appeared, sometimes called "personology." The individual who is a close student of human beings is willing to be eclectic and to accept hypotheses, or develop hypotheses of his own, testing these by approved scientific method in the hope that he may ever come nearer to the truth.

The importance of the contribution which could be made by psychology to the rehabilitation of the disabled was recognized by Dr. Ira Scott and his staff in the Veterans Administration long before the need for the Vocational Advisement Service of this agency of government was made acute by World War II. Dr. Scott and his staff were ready to meet the challenge of the moment; and the Manual of Advisement and Guidance developed under his direction is, in the opinion of many, still the greatest single, concise contribu-

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[†] "Reviewed in the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the authors are the result of their own studies and do not necessarily reflect the opinion or policy of the Veterans Administration."

tion to the field of rehabilitation, integrating the use of known principles of psychological study of the individuals and groups with the other segments of the rehabilitation services. It is this document which is presently the guiding light of the service in Veterans Administration Hospitals. It is this document which points clearly, even if by indirection, to the vast difference between the clinical psychologist and the social psychologist who is known as simply a "psychologist," and is given the title of Chief of the Vocational Rehabilitation and Education Section. He is often referred to simply as the vocational adviser or as the hospital adviser.

The vocational adviser who works with the rehabilitation services of the hospital is a psychologist who has, in the main, two types of equipment. The first we shall call the psychometric and the second we shall call the clinical.

Equipment of the Vocational Adviser

The psychometric equipment includes all those instruments which have been used with a sufficiently large number of people to obtain data available as to the performance of a group. These data have been treated by statistical procedures, sometimes called the "arithmetic of human welfare," to establish certain estimates of parameters based on the study of samples of population. The responses of the *individual* (referred to by the psychologist as the *subject*) who is being estimated are predetermined as right or wrong within definite limits. By the use of psychometric equipment, therefore, any subject may be compared with a known sample of the population and given a rank of some kind such as a standard score, a T-score, a centile, or the like, which shows him in comparison with that specific group.

Many of the psychometric instruments available today have been in existence long enough so that there is a substantial body of experience with them, and the psychologist skilled in using these is able to gain a great more from them than the mere mechanics of scoring and assignment of normative ranks would imply.

The clinical techniques available to the psychologist are less comforting in that they have no refuge of numerical preciseness in which to express findings. The best of the clinical materials have no preconceived rights and wrongs as to the responses. The subject himself reacts to the stimulus outside him freely and expresses himself freely by the drawing of a house, a tree, or a person; by the tracing of certain lines which are presumed to follow a pattern set before him; by describing what he sees in the formless splotch of colored ink on a piece of paper. He presents his reactions in his own individual way. The satisfactory use of clinical techniques is dependent far more upon the breadth and depth of the psychologist himself and his wide knowledge of human beings than upon strict adherence to a technique for the manipulation of data.

Psychological testing at its best is the study of the reactions and performance of a given subject under well-controlled conditions over a relatively brief time, for the purpose of ascertaining how this individual will fit into the society of which he is a part. Psychological testing is an essential part of the equipment of the hospital adviser.

But the world in which patients will live after they have left the hospital is a competitive world, where satisfactory adjustment is reached through effort and ability and through the opportunities presented for the utilization of the right man in the right place. It is for this reason that the hospital adviser must have at his disposal a fairly large and workable file of occupational information, as well as contacts with potential employers who may be able to utilize the services of patients after their discharge. The maintenance of an adequate occupational information file is a frustrating challenge in many ways, because the occupational picture changes rapidly. Long-time trends for a state or a nation may be available; but these are somewhat like the Dow-Jones averages on the stock market. They indicate broad movements but they have little to do with *specific employments.* General trends have as little to do with Joe Blow as elevator man in the Commerce Building on the corner of Fourth and Pine Streets in Any City, U. S. A., as do the Dow-Jones averages with whether or not the stock of the Tidy Fire Fighter selling at three and a quarter today will be worth ten thousand dollars in ten years. The file of occupational information must, of course, contain the nation-wide data; but there is no substitute for the specific, personal knowledge of what is going on in a real community, and the exact knowledge as to how one particular patient may find his best opening for employment.

The patients themselves, who are the subjects of Medical and Vocational Rehabilitation, are infinitely varied. Accident and disease will attack with impartiality the best trained and most broadly educated professional or executive person as they will the "wetback" who has come to the United States in the hope of finding his own particular pot of gold at the foot of his rainbow. Long-time trends as regards disease, accident, employment, or any other specific data may be estimated. Were it not for this, life insurance companies would be powerless to remain in business. The insurance company, however, is playing against known odds. The hospital adviser is asked to pinpoint patients in much the same way as an insurance company would be asked to pinpoint one of its risks if it were required to say with certainty that Jane Doe would die at 4:30 in the afternoon on August 12, 1961, in an automobile accident on Highway 30 just outside Cheyenne, Wyoming.

It is for this reason, therefore, that the hospital adviser tries constantly to make "good errors" rather than direct hits.

The vocational adviser must have a frame of reference in which to study his patients, and the following is suggested tentatively. The social sciences are noted for the inexactness of their data and the paucity of their constants. It is for this reason that these as constants for all people are offered with some temerity; however, they do form the main essentials of the frame of reference in which to consider patients: (1) all human beings like to be liked; (2) all human beings require security; (3) all human beings require competition; (4) all human beings possess a "moral floor," and (5) all human beings must communicate with others. These catch phrases need explanation.

Under the first of our headings, "all human beings like to be liked," is placed that component of personality which is regarded as one of the essential constants and which covers a vast amount of territory in the psychological literature. It includes that broad and often abused word "love," for which we have but one symbol in the English language. It covers what the ancients called agapao, fileo, and eratio. It covers all those components of the personality involving the out-reaching need for approval, affection, and family support. It carries with it a bit of the old adage that "it is possible to catch more flies with honey than with vinegar."

"All human beings require security" is the constant which includes everything from the first demands for warmth and nourishment upon the part of the helpless infant to the need for some assurance to the individual of his place in society, recognized with appropriate dignity and providing satisfactory societal and economic rewards.

The obverse of this constant is the need for competition, which in its way may be said to be the need for *in*security. If the need for security be satiated, a kind of stupefaction of the individual takes place and emotional and intellectual atrophy results. This constant may be stated in the terms of another adage: "Every dog requires a certain number of fleas to keep him happy."

The fourth constant, "possesses a moral floor," applies to the great mass of socialized human beings far more clearly than it does to that small and baffling group often referred to as having inadequate personalities, or sometimes as being psychopathic deviates. Until either utter inadequacy or sheer disintegration has tended to obliterate almost entirely this constant, the individual responds to social stimuli according to an observable and describable code. There are certain things which he regards as good to do. There are certain other things which he regards as evil. The thesis here is that a code exists, not that all people have the same code. If an individual has been taught from infancy that it is virtuous to steal and criminal to be caught, he has guilt reactions only as the result of being caught.

All human beings must remain in communication with their fellows. Throughout the entire animal world there seems to run a necessity for communication, ranging from the tapping of antennae by ants to the invention of that terrifically complicated way of impeding communication among human beings, known as language. It is the inability to satisfy the need for communication that creates that utter loneliness and isolation frequently found in its purest form in the aged, whose associates have all passed away and whose ties with the living are but loosely fashioned. One of the most terrible sentences that can be inflicted upon a prisoner is that of solitary confinement, which prohibits by any physical means communication with the world of which he has been a part. Even though ascetics have immured themselves behind cloistered walls, their demand for communication is satisfied by real or fancied contacts with the Divine or the spiritual world.

These constants have been sketched but lightly owing to the brevity of time; but they form essential elements of the frame of reference in which the patients on the rehabilitation service of a hospital are considered.

The Interview

There is a right and a wrong time for the referral of patients to the vocational adviser, and the development of rapport between the patient and the psychologist is an extremely delicate part of the relationship. Mechanical devices used to establish rapport are the individual survey and the preliminary interview. Already, before the patient has seen the psychologist, many facts of his history have been accumulated in his record and these facts are taken from the records so that they do not have to be recaptured. This means that the patient's chart goes to the hospital adviser far enough ahead of the interview so that vital statistics and medical history are at his disposal. The interview can start on common ground. The adviser may rapidly check over the facts of birth, military service, marriage, and divorce, and then give most of his emphasis to the social history, educational background and work history which have, heretofore, been of less importance to the physician or to the social worker. It is all too frequently found in experience that a patient may have reported, as far as his history is concerned, that he is married. He has not disclosed the fact that he has been widowed or divorced. The interview is one of the most delicate parts of the entire relationship and may not be entrusted to unskilled hands. It is quite possible that there will be points revealed in the interview which should be regarded as privileged information and should remain only in the locked files of the adviser. This point needs no underlining to a group of physicians.

Areas Tested

Upon the establishment of rapport and the development of the interview, the patient must very quickly have the idea implanted in his mind that he is to help himself through his own efforts almost entirely and that with only a little push here and there from those outside him will he be returned to society as a wholesome, producing member. It is for that reason that the use of testing instruments must be delicate.

Areas which may be sampled by testing have been grouped under several heads, each of which will be briefly characterized.

1. Where do the interests of the patient lie and how strong are these interests? It has been said. "Where a man's treasure is, there will his heart be also." Much work has been done in the field of estimating interests, and many useful inferences have been drawn on the basis of interest tests. This is hardly the place in which to advertise certain specific testing instruments, *but it is safe to say that most of them provide a kind of scatterbore shotgun* with which to begin hunting. The interest test itself is often a long one of many items and the patient becomes fascinated by the wide variety of choices he must make. Occasionally he returns the paper with very poor response because he says nothing interests him. Sometimes it is very well to approach him with the idea that the test is played like a game and he is to pretend that he must make certain choices rather quickly, deciding on the spur of the moment without too much reflection as to whether he is qualified or has the physical ability to do the things he thinks he might like to do. The literature of interest testing is replete with many references, among which the consensus seems to be that the wider and richer the pattern of interests, the more hopeful it is that constructive work with the patient may be accomplished.

2. Another of the areas that may be sampled by testing means is that of personality. Personality schedules have their strong defenders and their vigorous attackers. They have many faults, but, nevertheless, an estimate obtained from the patient himself of some of his own attitudes is certainly very useful. Some notion may be gained of his tendency to be impulsive or to be reflective, to be tolerant or intolerant, to be secure or insecure; these are a few of the things that may be surveyed by pencil and paper. Often these surveys are indicative only of the need for more searching study of the personality. The term "personality" itself has been used very loosely to cover every phase of intrapersonal and interpersonal attitudes and relationships which would have a bearing upon suitable social and economic adjustment. It has often been said that more people are fired because the boss doesn't like them than because they are incompetent. It has been found that it is just as essential in satisfactory job placement to have the individual in an environment, human and physical, in which he can accomplish his best work as that he actually have a kind of work which he can do and do well.

3. Another area which may be estimated by test devices is that of achievement — how much know-how does the patient have. Many of the achievement tests are based upon academic experience; some of them are based upon the accumulation of information; and some are based upon the specific knowledge that may be acquired through familiarity with mechanics, music, art, or some specific field. Academic records supplement at this point as also does work by educational, manual arts, or occupational therapists. Whatever know-how has accumulated over the years as the result of either schooling or experience represents part of the essential equipment of the patient and is estimated as accurately as possible.

4. Still another area that may be investigated by tests is that of special aptitudes. In some cases, *work has been analyzed so that certain* basic

components have been isolated. An excellent example of this is one of the musical aptitude tests which segregates rhythm, pitch, tonal memory, and the like almost abstractly without regard for the esthetic side of musical accomplishment. Our aptitude tests generally are at best screening devices rather than the sort of instruments that would be most useful to the hospital adviser. The screening type of aptitude test is a psychometric one calibrated against a population in norms. By a device of this sort, a psychometrician in a personnel department in any factory can say with some safety that an applicant for a job has so many chances in a hundred of succeeding if he is employed, and he can indicate whether or not it is wise to risk hiring the person in question. A great deal more research must be done in job analysis and vocational study itself before the aptitude test will be improved to that state of refinement which is clearly indicated as essential in a hospital. Existing aptitude tests must be supplemented by work on the part of other members of the team before inferences may be safely made. Such tools as we now have, we use as far as it is possible.

5. Another area which has usually been called "intelligence" and which must be skipped over lightly, at this time has been subdivided for our purposes in the hospital into two: (a) Brightness and (b) Reasoning.

a. Tests overlap in estimating these two components; but every effort is made to find tests which indicate that the subject is bright enough to acquire new information and to use the content of knowledge. Some tests are semi-clinical and these have proved most useful in this search and have thrown a great deal of light upon the informational content, ability to concentrate, memory, and other characteristics of the subject which enable him to increase his knowledge intake.

b. Problem solving or reasoning is the other area of intelligence testing in which an estimate is obtained as far as possible. The literature of the latter is replete with differences between concrete and abstract thinking. Some subjects are able to think in the terms of highly concrete and specific physical entities, and their language is composed largely of symbols of that which is physical, which possesses mass, density — which can be manipulated. To some subjects, two plastic sticks placed to form a "v" with the apex away from them, this figure is always a roof. The world of experience is often translated into very specific, concrete content that has to do with particularized thinking and to them there is no generalization conforming to certain laws or theorems. Abstract thinking has been regarded as one of the highest forms of intelligence, as was pointed out many years ago by Immanuel Kant when he differentiated between the faculties of understanding and of judgment. In speaking of the faculty of understanding he pointed out that many lawyers, physicians, or others in professions might learn the rules by which their work was done and obey these rules perfectly in carrying out their work; however, some lack the power to perform the subsumptions necessary to the faculty of judgment. To Kant the faculty of judgment was the motherwit, the absence of which could not be remedied by any schooling.

The existing test materials overlap in many ways. The worker who is attempting to study his subject with any degree of accuracy will explore by their means as far as time and conditions permit. Toward the close of this exploration, it has been found helpful to bring the subject (the hospital patient) before the entire staff of the rehabilitation service so that a consensus may be reached and a course of action decided for medical rehabilitation, to stimulate activity on the part of the patient himself. The conclusions reached by the Rehabilitation Board, however tentative they may be, are put into writing and entered upon the patient's chart so that all members of the rehabilitation team may act in concert to assist the patient's thinking as regards his future. For example, if it is thought that he should consider clerical work in the field of business, the educational therapist may then try him out with typing and filing and bookkeeping on a preliminary basis before final determination to make the sacrifice necessary for retraining or for undertaking an entirely new field in which to seek employment. It is at this point that the "good error" principle of the study is paramount and every effort is made to see whether or not the patient will become a file clerk, a bookkeeper, a general accountant, a cost accountant, or a certified public accountant.

Under present conditions it is very useful for the hospital adviser to discuss with the employer beforehand as many of the patient's problems as possible, trying to give the employer some insight into the vocational handicap and its management. This saves a great deal of embarrassment on both sides. Many employers are charitable to a fault; and, especially when veterans of a war are concerned, are more than anxious to cooperate. Some knowledge of how best to meet the situation without embarrassment frequently spells success when failure otherwise would have been certain.

It has been found that personnel departments, particularly those charged with some responsibility as to the hiring of qualified personnel, are more receptive toward information that will better enable them to accept a new employee and keep him. Such personnel departments generally strive to maintain turnover at a wholesome minimum.

Some Charts in Summary

At this point it seems advisable that we should turn away from some of the general statements that have been made and look specifically at the graphic representation of some of the findings in an actual hospital situation.

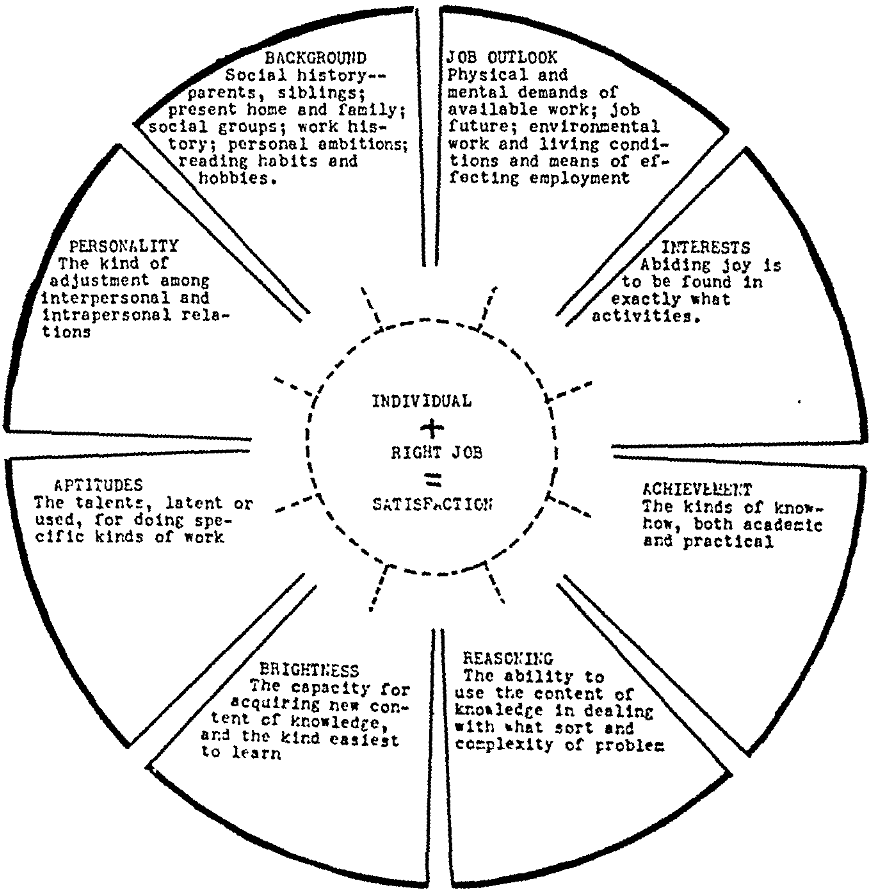
BACKGROUND
Social history--parents, siblings; present home and family; social groups; work history; personal ambitions; reading habits and hobbies.
JOB OUTLOOK
Physical and mental demands of available work; job future; environmental work and living conditions and means of effecting employment
PERSONALITY
The kind of adjustment among interpersonal and intrapersonal relations
INTERESTS
Abiding joy is to be found in exactly what activities.
INDIVIDUAL
+
RIGHT JOB
=
SATISFACTION
APTITUDES
The talents, latent or used, for doing specific kinds of work
ACHIEVEMENT
The kinds of know-how, both academic and practical
BRIGHTNESS
The capacity for acquiring new content of knowledge, and the kind easiest to learn
REASONING
The ability to use the content of knowledge in dealing with what sort and complexity of problem

Fig. 1. — The Rehabilitation Target.

Figure 1 is The Vocational Rehabilitation Target. Equal space is given in this figure to each of the areas in which testing is done, plus two more: Background, and Occupational Information. These two segments are placed at the top of the chart, and are intended to stand for the bulk of the information obtained by means other than testing. The other areas all refer to information obtained largely by means of testing, supplemented by observation of the patient by various members of the Medical Rehabilitation team cooperating in the pre-vocational phases of vocational advisement. The equality of size does not intentionally indicate that equal stress is given in each case to each phase of the study; the emphasis is determined by the individual problems of each patient Each is, however, of equal importance in reaching a decision with the cooperation of the patient as the best and most clearly defined course he should follow in his search for work that will be profitable to himself and to society.

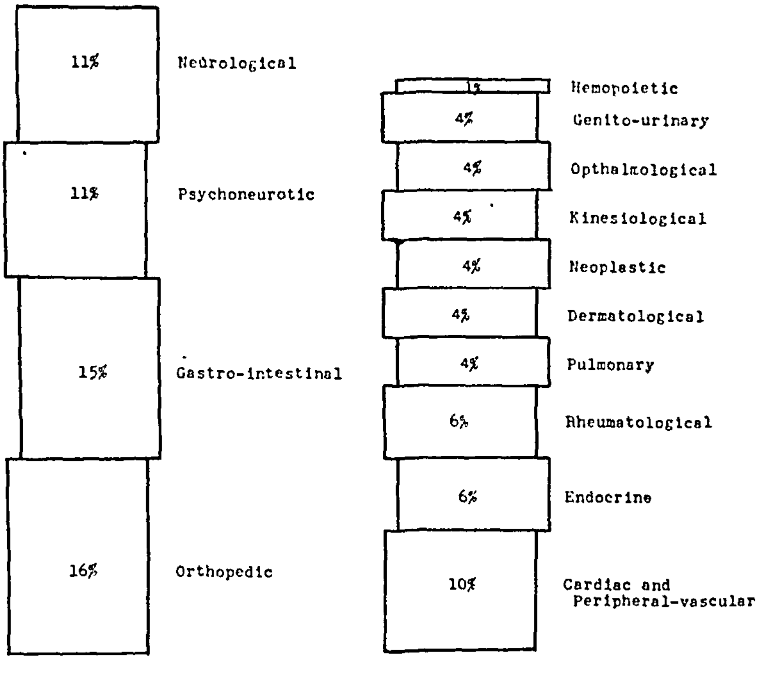

Fig. 2. — Proportionate Referrals for Vocational Rehabilitation as Regards Broad Diagnostic Categories.

Figure 2 indicates the proportion of cases from the standpoint of the medical diagnosis. Many patients carry diagnoses covering more than one of these areas; but the major one only was used in this compilation. For example, it is quite possible for a patient who is receiving compensation for a service-connected orthopedic disability also to have non-service-connected opthalmological or kinesiological disabilities. Much space could be devoted to the complications of any given case because of the mental and physical conditions which prevail. About all that can be done by means of this chart is to underline the complexity of the problems as a whole presented to the Physical Medicine Rehabilitation Service in each individual case. It should be observed that the classification of pulmonary disorders shown here does not include any patients known to be suffering from tuberculosis. The experience in this hospital of less than a year with tuberculous patients is deemed insufficient to warrant their inclusion.

Figure 3 shows the proportional pattern of the objectives as planned in the various counseling programs completed in the hospital. The terminology on this chart is based on the Dictionary of Occupational Titles and could be broken down into a much greater refinement. For example, the classification "professional, semi-professional, and managerial," which covers in the Dictionary the code numbers between 0-0. and 0-9., includes teaching, photography, and technical work in connection with laboratories, newspapers, radio and television, and many others. The clerical and sales field is relatively the largest because the turnover in this field is sufficient to provide employment opportunities much more readily than in many of the other fields. The skilled worker area includes the apprenticeable trades. Owing to the fact that many apprenticeships are no longer open to men past twenty-five years of age, this area should be smaller in the future as the age of the veteran's group increases, making it more difficult to place workers in the skilled trades. The hospital used in this report is located in the Northwest, where forestry and fishing are major occupations. Many of the jobs in these areas require a degree of physical fitness beyond that which disabled veterans possess. Frequently those who are associated with work in forestry or fishing enter through the semi-professional employment reflected in the first category discussed. There is a strong aversion on the part of hospital patients to entering an unskilled occupation or to entering one of the service occupations. Among the service occupations, barbering and police work are the two most often requested, and frequently are highly unsuitable to the applicant who desires to enter them.

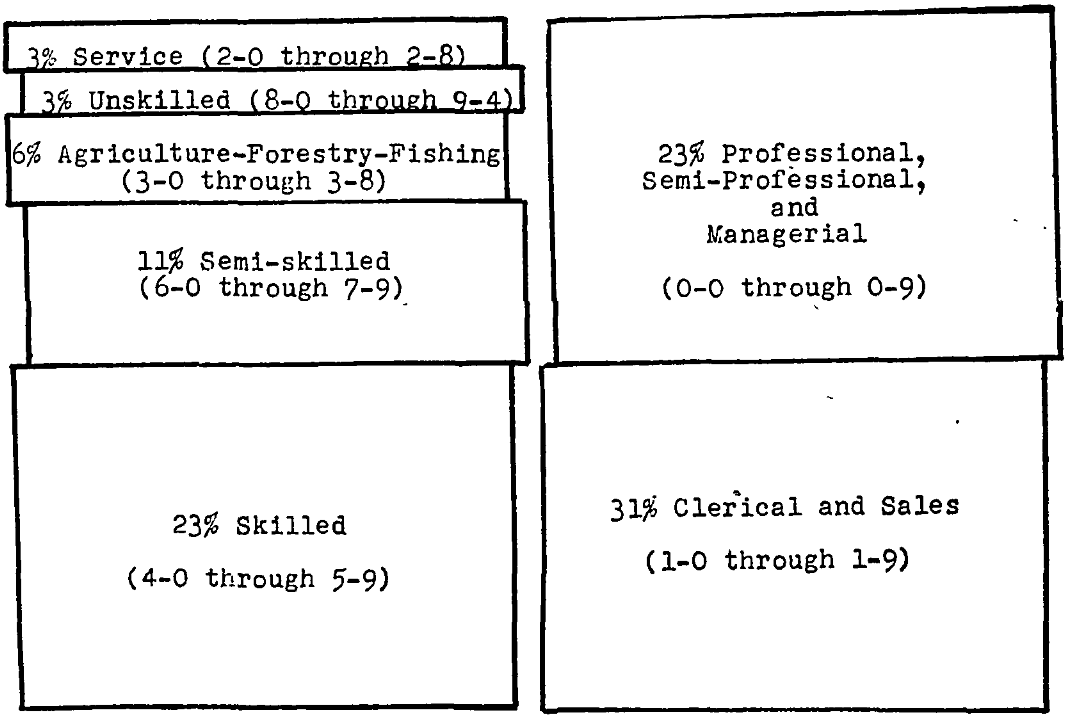

Fig. 3. — Proportional Selection of Vocational Objectives, World War II Cases, Through Counseling.

These charts have given a partial overview of conditions actually existing in a single hospital and summarize data from 1,028 cases over a four-year period. This report hardly represents research work in the purest sense. It is a record of what has happened. There are numerous problems in connection with the rehabilitation work which require research; but the turnover of patients is so rapid, and controls are so difficult to maintain, that research problems of themselves have so far remained problems. It is a hope maintained by all members of the staff in this hospital that some method of carrying research adequately will be developed and some solutions to problems worked out.

This discussion has attempted to provide some basis for an understanding of the work of vocational adjustment as a part of the rehabilitation service in a hospital. No doubt it will seem amusing even to its authors at some date not too far hence, because the employment of vocational advisement in connection with medical rehabilitation is very new and the guidelines within which his specialty will develop are rapidly coming into clearer perspective. In the few short years from which there is any experience by which to judge, the hospital adviser has been found most useful in completing that unfilled part in the teamwork required of the medical rehabilitation services in a hospital in order to return the vocationally handicapped human being to society with the firmest expectation that he will be an independent and self-supporting member of that society, and not an object of sympathy or pity — or public charity.

Discussion

Dr. Richard T. Smith, (Philadelphia): At a time when a young specialty, such as rehabilitation, is having very distinct "growing pains," a paper dealing with one of those pains is most welcome and timely.

Rehabilitation, like cerebral palsy, poliomyelitis, atomic power and innumerable other words has quickly caught on. Layman and physician alike speak of rehabilitation in a familiar, offhanded manner If most folk were asked to define the word rehabilitation, there would be as many different definitions as if ten people were asked to define the Foreign Policy of the United States.

The American Congress of Physical Medicine recognizes the need for the whole rehabilitation of a patient. It is in this specialty group that the techniques must be developed before they are passed on to the medical profession in general. As the "growing pains" are gradually eliminated the true meaning of rehabilitation will become less nebulous and more specific.

I feel sure that members of the American Congress of Physical Medicine are in complete agreement about the application of psychiatry and psychology in the general field of rehabilitation, not just in the rehabilitation of the psychiatric patient.

Ideally, rehabilitation should be conducted by a team, composed of a specialist member for each of the medical fields involved during any individual rehabilitation program. Such a team, unfortunately, is not practical in the majority of our medical institutions, for in-patient or out-patient care. In actual practice, most of the time, those members of the team who are available are required to "double in brass," indeed, all too frequently the team consists of a "one-man-band."

At the moment, one member of the ideal rehabilitation team is under consideration. In discussing the role of the rehabilitation psychologist, there are certain theoretical and practical considerations which need mentioning.

Theoretically, the psychologist can, by psychometric testing, plus a knowledge of the patient's background and personality, determine his vocational ability to return to a useful and productive occupation. This information should then be a guide for the physical, occupational and psychiatric rehabilitation of the patient.

Practically,

1. The psychologist should have an opportunity to work with the patient in the hospital, but in most civilian general hospitals the period of in-patient care is all too short.
2. The psychologist must be well trained for this type of work. Such well trained specialists are few and far between. In fact, too many psychologists are trading on the ability and success of their better trained colleagues and are doing more harm than good.
3. A psychologist, capable of this type of work would command a good salary, which would increase the expenses of already financially overburdened hospitals and patients.
4. The effectiveness of psychometric testing is questionable from the vocational viewpoint. These tests tend to rule-out rather than point-out the individual aptitudes. On the other hand, they can be very helpful in determining the cause of a neurosis.

It is interesting to note the lesson in psychology presented to us today. For several days we have been exposed to reports, papers and discussions on numerous subjects related to physical medicine. For the most part they have been recitations of fact and fancy, illuminated at times by lantern slides. Our invited guest in presenting his paper has inflated our egos by almost apologizing for his intrusion into our august body; expanded our intelligence by explaining only the purely psychological features which might not be completely clear from our educational background; heightened our interest by informing us he would give only a brief report of this extensive paper (and really made it brief).

As premedical students we are taught how to "win friends and influence people" by our exposure to psychology courses. In medical schools psychology is almost universally lacking, not only in the curriculum but all too often in the professors who train us. This is a great loss, since the emulation of such examples tend to help us to "lose patients and fail to collect bills."

The authors of this paper are to be congratulated on introducing a very important factor into the field of rehabilitation. I am not sure that their suggestions are practical. I am certain that applied psychology is a must in rehabilitation. I wonder if the object might not be better served by training the physiatrist, psychiatrist or internist in psychology as it applies specifically in medicine.

USE OF PAINTING IN REHABILITATION OF TUBERCULOUS PATIENTS [*]

A. RAY DAWSON, M.D.[**]

RICHMOND, VA.

Two years ago we initiated a study looking into the relative value of the procedures used in our department of Physical Medicine and Rehabilitation and one of the procedures to come under close scrutiny was that of the use of painting and drawing. Our findings relative to the use of this subject have furnished the material for the present discussion.

We have been using painting as a therapeutic procedure since the Fall of 1946, at which time one of our instructors in Educational Therapy, devoting her primary time to foreign language, but with experience in art instruction, was able to change her schedule in order to meet a demand from the Neuropsychiatric Service to devote two hours a day to instructing psychotic patients in art. This first class was a success, and over a period of one year the demand had increased to such an extent that she was devoting full time to painting instruction. Since that time, painting has shown a steady growth to where, at present, we are making arrangements to expand our utilization of volunteers during the coming Winter.

Painting, like other procedures used in Manual Arts Therapy and Educational Therapy, is difficult to evaluate, since it does not lend itself to any type of solid statistical study, and in the final analysis we are largely dependent upon clinical evaluation. In this connection, an interesting circumstance occurred during the period of our study. A little over a year ago we lost an art instructor by marriage and resignation. This resignation came at a time when the Veterans Administration was going through a reduction-in-force and a general tightening of personnel ceilings. My efforts to save the position of art instructor would, I am sure, have been unsuccessful had it not been for the strong pleas made for the continuation of this service by the Chiefs of Tuberculosis, Neuropsychiatry, and Paraplegia. The efforts on the part of these three Chiefs of Services while pleasing to us, at the same time placed upon us a responsibility to study in even more detail the rationale for the use of painting, to search out the pertinent factors which made this a good therapeutic procedure, and to develop these factors to the highest point attainable.

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[*] Read at the Twenty-Ninth Annual Session of the American Congress of Physical Medicine, Denver, Colorado, September 7, 1951.

[*] Reviewed in the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the author are the result of his own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

[**] Chief, Physical Medicine and Rehabilitation Service, McGuire Veterans Administration Hospital and Assistant Professor of Clinical Physical Medicine, Medical College of Virginia, Richmond, Virginia

The largest number of patients engaged in painting come from the Neuropsychiatric Service. Painting has become an integral part of the diagnostic and therapeutic armamentarium of the Psychiatrist. The acceptance of painting and the rationale for its use in this field is richly attested to by the volume of literature on this subject that can be found in any medical library.[1-12] However, there seems to be a drought of literature on the use of painting in tuberculosis or other medical conditions. It is, therefore, our purpose to emphasize the use of painting as a therapeutic procedure in the treatment of tuberculosis, with the understanding that much of the rationale for using this subject in tuberculosis can be applied to other medical conditions, especially cardiovascular and gastro-intestinal diseases. Before leaving the subject of the use of art in neuropsychiatric cases, attention should be called to the work done by Dr. Benedict Nagler, Chief of Neuropsychiatry at McGuire Veterans Administration Hospital.[13-14]

Phthisiologists tell us over and over again that the treatment of tuberculosis is built upon a foundation of rest, both physical and emotional, and as we go back to our studies of psychology, we realized that it is impossible to have complete physical rest without emotional rest. In fact, even when the patient is asleep, we have witnessed much physical exertion accompanying an uncomfortable dream. Dr. Roy Myer Simpson, in discussing the emotions and tuberculosis, states as follows: "If they (the emotions) find no outward expression they are likely to backfire into the internal mechanisms of digestion, glandular organs of internal secretion, the sympathetic nervous system, or other vital bodily processes and cause serious organic disturbances — tubercular bacilli thrive on emotional excitement. Excitement churns the tissues of the lung. To control tuberculosis, we must first control our emotions." [15] Thus, if a procedure used in Physical Medicine and Rehabilitation is to be of real value, it must meet the first criterion — REST — and thereby must assist in producing rest. Clinically, we have found that among the patients who become interested in painting as a hobby, it becomes a restful relaxation.

As illustrative of this rest producing factor, the following is quoted from the art therapist's report presented to our Tuberculosis Rehabilitation Conference. Mr. A. O. is a white male in his late fifties which has been an extremely active individual. In the past he has been at various times a school teacher, farmer, and forest ranger. He has suffered from tuberculosis for

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11. Rank, Otto: Art and Artist, Tudor Publishing Company, New York.
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15. Pattison, H. A.: Rehabilitation of the Tuberculous, The Livingston Press, Livingston, New York.

years and apparently must spend at least two or three years more "on the cure." It was especially difficult to arouse this patient's interest because he had, as so often happens with patients in his age group, developed the attitude that he had come to the hospital to die. The therapist issued the patient sketching materials and played upon his interest in animals and wild life. From shaky sketches done at his bedside, the patient progressed to pen and ink drawing and from these to oil paintings which were copies of other paintings or photographs. The patient has developed such self-confidence that he is now executing fine original paintings. He is enthusiastic about his work and paints regularly. When the patient discovered that he could successfully participate, he widened his sphere of interests until they, at present, include most of the activities offered to tuberculous patients. This drastic change in attitude and outlook on life was brought about mainly by the exploitation of a small glimmer of an interest in art.

Before leaving our first and most important criterion — rest — we do wish to bring to your attention a word of warning. It is our opinion that painting must be used solely as a hobby and not as a vocation, if it is to be successful in bringing about rest. In discussing this point, a well known phthisiologist, gave me a case history from his own experience. A woman portrait painter, who was healing her lesion well, was allowed to continue this work two hours a day. Very soon she started to go downward. Upon discontinuing painting, she reversed the process and again went on to healing. She later went to Switzerland, where she was allowed to paint landscapes and continued her healing process without interruption.

In our own experience, we have in the hospital at this time a tuberculous patient who is a commercial artist, an illustrator for one of the Government departments. When we first enrolled him in our art class, we did so with much anxiety, fearing that he would rapidly revert to his normal vocational work of illustrating. This, however, did not happen and, at present, he is completing a typical painting produced by a tuberculous patient. It is a cool body of water, against a background of rolling hills, shaded by stately pine trees. He has made an increasingly good adjustment to his ward surroundings. He has developed a wonderful sense of humor. His latest cartoon, which we found circulating on the ward a few days ago, was a picture of himself floating in mid air after a pneumoperitoneum injection. Needless to say, he is one of the most popular patients on the ward.

A second criterion which our procedure must meet in the treatment of tuberculosis is that the activity must not be exhausting. In fact, the less energy consumed, the better. Of all the procedures we use, painting meets this criterion best. The average sketch pad weighs 4 ounces, canvas with the stretcher weighs 24 ounces, sketch pencil and painting brush about an ounce each. One can paint or sketch while lying in bed, sitting in a chair, or standing. It is most important, however, that the body be in a relaxed position. Energy consumption is practically nil. We, therefore, see that painting meets our two basic considerations — it does produce rest and it does not consume an appreciable amount of energy. It is not fatiguing. But painting does much more than fill these two criteria. It, (1) catches and holds interest and overcomes boredom, (2) gives pictorial reality to the wish to be out-of-doors, (3) creates wholesome fellowship, and, (4) partially satisfies the creative urge and brings recognition. These criteria will be discussed seriatim.

(1) *Catches and Holds Interest.* — The majority of our patients are from rural areas and from schools that did not have departments of art or art

education, yet about 12 to 15 per cent of our tuberculosis patients are interested in this field of endeavor. Most of our patients have not only lacked education in art or art appreciation but painting to them was thought of as kind of a "sissy" hobby. This is illustrated by an experience that we had in convalescent hospitals during the recent war in connection with classes in music appreciation. Frequently rough "hard boiled" Army personnel attended a class in music appreciation out of curiosity and a desire for an opportunity to do some "griping," only to remain because of sheer enjoyment from the thrill of listening to the universal language of emotional expression. There is apparently much latent talent for the arts which is awaiting an opportunity for expression. Normally, our art instructor sees a patient first when he is strictly confined to bed. The instructor will give the patient a sketch pad and pencil with a few words of instruction. If the patient shows sufficient interest to complete two paintings he has become a confirmed hobbyist; he has learned to see a picture in commonplace things. He has learned that he has the ability to project his mind's eye view on canvas. His interest is solid and remaining.

(2) *Painting Gives Pictorial Reality to the Wish to Be Out From Behind Doors.* — The predominance of quiet open spaces and outdoor life is by far the most outstanding single characteristic found in paintings done by the tuberculous patients. Their painting to a large extent, follow similar patterns — cool water, light colors, rolling background in horizontal panels and with quiet wild life — rest, relaxation and contemplation. A recent survey of the paintings found in our tuberculosis art studio revealed that of the 57 paintings present, 46 were of the above characteristic, 11 were still life and portraits, two being for floral arrangements.

(3) *Painting Creates Wholesome Fellowship.* — As the patients become more interested in art, they find a group of art hobbyists ready to welcome them with open arms to instruct our neophytes in the small techniques that add to better productions. He learns a new and interesting language. He finds that in addition to painting as an outlet his fellow enthusiasts are usually interested in music, books, and the like, all of which add to the enjoyment of life. As our patient reaches the ambulant state, he has available an unofficial group called an art club using the art studio in the tuberculosis building as their headquarters. Artists and art students in the City of Richmond are frequent callers. Once a year the tuberculosis patients put on an art exhibit for one afternoon, which was attended by some 235 visitors from the city and the hospital last Fall. When a patient becomes eligible for club membership, he is given a key to the studio in order that he may have full access to the area. This studio is a very cozy room off to itself and having a reasonable amount of suitable furniture. There is an automatic phonograph and an excellent collection of fine phonograph records, plus an art library. Many of our case histories show that patients who did not adjust to the hospital prior to taking up painting have adjusted well since engaging in this activity.

The feeling of clubbiness and mutual interest which becomes characteristic of the patient who enters into art activity has some disadvantages. At times these patients have been called "snooty," but the advantages outweigh these complaints, for these patients are interested in each other. They feel that as a group, they have the responsibility for each others adjustments to the hospital.

(4) *Painting Partially Satisfies the Creative Urge and Brings Recognition.* — To analyze elements that are manifested by the creative urge would ex-

ceed the limits of this paper. Life by its very nature is reproductive and expansive. Individuals live by recognition of these two basic phenomena. Any chronic, prolonged, debilitating disease not only stifles this urge but at times erases the process of expansion. Man's expansion in business and community life is, of course, usually cut off by prolonged hospitalization. Recognition by the community becomes practically non-existent. These things — CREATION and RECOGNITION — are vital forces in our life. A few days ago a group of us were walking through the tuberculosis building when one of the patients, who in the past was of the problem case type, came up to us without a word of complaint and proudly showed us a picture of our outdoor swimming pool and bathhouse. The picture was not particularly good but as he caressed the frame his facial expression told us more about the picture than his words. He was the proud creator, who deserved and received recognition from us.

Summary

Painting, like music, is one of the universal languages — expressing a desire to create, place in order and bring about rhythm. It is used by man to pass on to his contemporaries and descendants a noble idea which may be used as a foundation upon which to build. Somewhere in the treatment of tuberculosis our patients learn to recognize their physical limitations, and perhaps the enforced rest stimulates appreciation of the arts. Quietness does not dull the senses but it affords an opportunity to withdraw from the superficiality of the world. It has been our experience that many of our patients who were unaware of the fact that they possessed talent for painting have turned out pictures of high quality that can be viewed with a feeling of restful quietness and faith in the future.

Discussion

Dr. Florence I. Mahoney (Memphis, Tenn.): Dr. Dawson's paper is an interesting discussion of one of the phases of rehabilitation which has proved to be an excellent treatment medium for several kinds of patients. He has been fortunate to procure and be able to hold and pay for a full time Art Instructor. Many of us are not so fortunate. Instead we must be satisfied with an Occupational Therapist or Manual Arts or Educational Therapist who knows some art and who does this as part of his or her work.

In our hospital, art is used therapeutically in Occupational Therapy. We have no one who is primarily an artist, but several Occupational Therapists who know enough about painting, ceramics, and other art forms to use it in the treatment of patients. We also have a Volunteer paraplegic woman who was formerly an art teacher who gives one day a week to the patients, when she is able to get to the hospital. Her enthusiasm and knowledge of teaching art have interested a number of patients in this form of expression.

We have also found painting a useful form of treatment for the TB patients. Frequently they start with stenciling, which is a small project, easily set up for a 20-30 minute treatment when the patient is in Group II or III, working in bed. With this form of art a patient may learn shading, how to mix paint, and something about design. Then he may paint ceramic tiles, which brings in some free hand work and imagination on the part of the patient. The third step is to try charcoal or pencil sketches and then pastel sketches, using colored chalk. These are satisfying, fairly easy to do, and a means of learning shading in a fairly easy manner. By this time the therapist knows whether or not the patient has any talent for art, and whether he is really interested in going into it more deeply. He then is started on water colors and oils.

Our Occupational Therapists have found the use of plaster molds very effective for teaching perspective on the ward art program. They have made a square, a ball, a cone and a cylinder. These can be arranged in a group, in different patterns, or used individually. They are a part of the ward cart equipment, and can be set on a table on the ward or in a window sill. The patient sketches in charcoal or pencil. They are easily adaptable to the short periods used in the early phases of tuberculosis. We also use the portable easels on the ward so that the patient can sketch while still a bed patient, and yet be comfortable and use little effort in this work.

For the patient who has little talent for drawing but who still wishes to attempt some painting, we have found the Picture Craft Kits put out by the Picture Craft Company in Decatur, Illinois, very helpful.

The patient gets a great deal of satisfaction out of painting a picture, and it is difficult to fail with this method. Each part of the picture is numbered, and the colors for each number and a paint brush come with the kit. Outdoor scenes, still life, animals, etc., may be procured for painting in these kits. This type of painting often stimulates an interest in learning to draw and paint in a patient who has had no experience in this sort of thing before.

More patients who participate in painting and drawing use this form of art as a hobby or follow it up as a vocation after their hospitalization than any other form of Occupational Therapy.

We have also used art as a form of functional therapy and have had two quadriplegic patients learn they had a talent in art after their injuries, and one of them is going to art school full time. These boys worked in Occupational Therapy to learn all possible use of the upper extremities. Usually they begin with stenciling, and possibly do some copper tooling to learn the motions they will need in feeding, or any movements they can develop and may wish to use to be more independent. A few have become interested in painting and have tried using a brush attached to a hand appliance. He uses this appliance for his art work. This patient is having some hand surgery done this summer with the hopes of getting some function in this right hand.

Our experience with using art for a professional artist has been the same as that of Dr. Dawson. Since they already know a great deal about art, it is not the means of relaxation and the stimulus to a hobby development that it is to one who has not had the opportunity to work in art previously.

Dr. Dawson is to be congratulated for developing an art program for tuberculosis patients which reaches as many patients as he states. He is also fortunate in having a full time art teacher to carry on this work. I feel sure that one of the reasons it has worked so well is that a full time therapist who knows art and the therapeutic approach in teaching it, and has a great deal of enthusiasm for her job, is in charge of the program. However, those of us who are not so fortunate should be stimulated by this paper to develop a better art program for our long-term patients.

Dr. A. Ray Dawson (Richmond, Virginia): There are two things I want to answer. First, our "female therapist" is a great big he-man, a World War II veteran, who teaches art now.

Secondly, we use art extensively for paraplegics. We have a number of paraplegics who are now making their living at it. I started to put into my paper a comparison of the art of a paraplegic and that of a tuberculous patient. It is extremely interesting. The paraplegic paints nothing but rigid pictures. Usually they are copies. I don't know why that is so. The sketch pad of the paraplegic will contain sketches of the human figure, and things of that nature, but when he starts painting the picture becomes rigid. It is a copy.

I think somewhere we are dealing with this business of body image. I would like to learn more about it. I am going to make a study of it this coming year. I don't know what we are dealing with in relation to the art of the paraplegic, but it is an extremely interesting thing.

As to whether I would sacrifice an occupational therapist for an art instructor, the answer is, yes. That is one of the reasons for this paper. I think we are overlooking the use of art. I believe we can reach a lot of patients we are not reaching now. I would not sacrifice the only occupational therapist that I have, of course; but as I have some fourteen, I would sacrifice one for an art instructor if I had to do so.

* * *

ISCHEMIC NECROSIS OF THE ANTERIOR TIBIAL MUSCLE *

Report of a Case *

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Physical Medicine Service
Walter Reed Army Hospital
and
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Necrosis of a muscle or group of muscles can be anticipated following adequate trauma that obliterates the blood supply. The anterior tibial muscle seems to be particularly vulnerable to ischemic necrosis from mild and indirect trauma. Tillotson and Coventry[1] have recently reported a case of spontaneous ischemic necrosis of the anterior tibial muscle. They credit Vogt[2] with first reporting this condition in 1943. Horn[3] reports two cases of ischemia of the anterior tibial muscle in soldiers, following long marches. Other cases have been reported following varying degrees of trauma or stress.

Tillotson and Coventry[1] state the typical findings in spontaneous ischemic necrosis of the anterior tibial muscle are: "(1) pain, localized about the ankle and in the anterior muscular compartment of the leg, the onset of which occurs during physical activity; (2) swelling of the leg, especially over the anterior tibial compartment; (3) glossy skin over the affected area, and (4) paralysis of dorsiflexion, and at times temporary paralysis of the peroneal nerve."

Case History

A male soldier stepped from a train in Japan on December 14, 1949, and twisted his left ankle. There was some slight pain at the time, which grew progressively worse. Patient reported to his local dispensary on December 16, 1949. The ankle was wrapped with an ace bandage and he was placed on a quarters status. The pain in the ankle continued and swelling and tenderness developed in the anterolateral aspect of the lower half of the left leg. He was admitted to a station hospital on December 21, 1949, and was treated with penicillin, sulfadiazine and elevation of the left lower extremity. Patient developed a left foot drop and on December 30, 1949, a posterior plaster splint was applied. He was evacuated to an Army hospital in the United States, where he arrived on February 25, 1950.

At the time of admission to the Neurosurgical Section of the hospital the patient had no complaints other than the drop foot. Routine blood and urine studies were within normal limits. X-ray of the left leg revealed no bony or soft tissue abnormality. The left ankle was slightly swollen and there was marked induration over the left anterior tibial muscle. There was hypothesia over the lower third of the anterior and lateral leg and the web between the first and second toes, left foot. The patient was provided with

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* Walter Reed Army Hospital, Physical Medicine Service.

[1] Tillotson, J. F.; Coventry, M. B.: Spontaneous Ischemic Necrosis of the Anterior Tibial Muscle: Report of a Case. Proceedings of the Staff Meetings of the Mayo Clinic 25:223 (April 26) 1950.

[2] Vogt, P. R.; Quoted by Horn, C. E., Page 622.

[3] Horn, C. E.: Acute Ischemia of the Anterior Tibial Muscle and the Long Extensor Muscle of the Toes, J. Bone & Joint Surg. 27:615 (Oct.) 1945.

a drop foot brace and treated by the Physical Medicine Service to prevent contractures.

On September 13, 1950, an electromyogram was done, using the intramuscular needle electrode technique.[4] Moderate fibrosis was found throughout the left anterior tibial muscle. This was most marked in the central portion as evidenced by resistance to the passage of the needle electrode during the exploration of the muscle. Absence of function in this region was revealed by electrical silence both at rest and on attempt at voluntary motion. Moderate fibrosis was present along the upper medial portion of the extensor digitorum longus. No needle resistance was found in the other portions of the long toe extensor or in the peroneous longus. Low voltage motor units, complex voltages and fibrillation potentials were present in scattered areas of the left anterior tibial muscle above and below the hard, tough central portion of the muscle. Continuous active fibrillation of denervation and normal motor units were found in all areas of the extensor digitorum longus and peroneus longus.

At this time a voluntary muscle test revealed the following strengths based on percentages of 100.*

Left tibialis anterior — 10
Left extensor digitorum longus — 85
Left extensor digitorum brevis — 85
Left extensor hallucis longus — 75
Left peroneus longus — 90
Left peroneus brevis — 90

The patient was receiving hydrotherapy in the form of whirlpool baths for the left lower extremity; electrotherapy (electrical stimulation) of involved muscles; active assistive to active exercise to mobilize the ankle and foot joints; and progressive resistive exercise to produce hypertrophy of the remaining muscle fibers.

In spite of continuous, vigorous therapy, throughout October, 1950, he failed to show any further functional improvement. If a sufficient increase in circulation could be established at the margins of the fibrosed muscles where ischemia may jeopardize the function of viable muscle elements, further improvement could be expected. Therefore, on November 8, 1950, a left lumbar sympathectomy was performed.

The physical medicine regime was then reinstituted ten days following this procedure and a marked softening in the region of the tough, fibrotic tissue ensued. Motor function continued to improve for the next six weeks, when he was returned to duty with 50 per cent strength of the anterior tibial muscle, 85 per cent of the extensor hallucis longus and 100 per cent of the peroneus longus and brevis. The toe extensors remained at 85 per cent.

Discussion

Weddell[5] is of the opinion that the fibrosed muscle is quite hard to penetrate with the needle and offers a "gritty" resistance to its passage. It is electrically silent in hard, fibrotic areas with fibrillation potentials in the lesser involved regions of the muscle.

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[4] Huddleston, O. L., et al.: The Use of Electromyography in the Diagnosis of Neuromuscular Disorders. Arch. Phys. Med. 31:378 (June) 1950.

*Key to Muscle Evaluation:
100% complete range of motion against gravity with full resistance.
75% complete range of motion against gravity with some resistance.
50% complete range of motion against gravity.
25% complete range of motion with gravity eliminated.
10% evidence of slight contractility with no joint movement.
0 no evidence of contractility.

[5] Weddell, G., et al.: The Electrical Activity of Voluntary Muscle in Man Under Normal and Pathological Conditions. Brain, A Journal of Neurology, Vol. 67, Part IV, 190, 1944.

The intense fibrosis of the central portion of the left anterior tibial muscle was revealed by extreme resistance to the insertion of the needle electrode and electrical silence in this region.

This case of regional anterior tibial necrosis is secondary to a minor injury with pain and swelling over the central portion of the antero-lateral aspect of the left leg, drop foot and some functioning of the muscle above and below a band of hard, tough muscle tissue. Since only this central band of muscle was not functioning either voluntarily or electro-myographically, the lesion would seem to be due to a vascular deficit rather than primary nerve injury, which one would expect to involve the entire muscle distal to such a lesion.

Mechanism of Vascular Damage. — The mechanism of the vascular insult producing the acute ischemia is not agreed upon. Hughes[6] has studied the vascular pattern of the anterior tibial muscles, on cadavers. He says, "The critical level of obstruction of blood flow which causes necrosis is not known, but it would seem that a localized complete occlusion of the anterior tibial artery is unlikely to cause necrosis; on the other hand, a longer segmental occlusion of the vessel, such as may be produced by arterial spasm, would obliterate the main channel by which retrograde distribution through the segmental branches may be brought about. In the light of present knowledge it seems that the most likelv primary cause of spontaneous ischemia is spasm of a large segment of the anterior tibial artery, beginning just below its anterior tibial recurrent branch."

Hughes[6] discusses surgical exploration and therapy when a case is seen within the first twelve hours. He also points out that necrotic tissues are prone to infection and gangrene and that there is a definite danger in exploration after the onset of necrosis.

Conclusion

It is felt that in the study of this patient evidence of ischemic necrosis of the muscle rather than any primary nerve involvement was obtained from the history, physical signs, clinical course, electromyographic studies and response to sympathectomy. The functional improvement following sympathectomy was due to the increased blood supply and hypertrophy of the viable muscle tissue present.

Summary

1. A case of anterior tibial muscle necrosis with partial common peroneal nerve involvement is reported.
2. Attention is invited to the danger of surgical intervention after necrosis is established.
3. The value of electromyographic studies in the diagnosis of a case of acute muscle ischemia is presented.

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[6] Hughes, J. R.: Ischemic Necrosis of the Anterior Tibial Muscles Due to Fatigue, J. Bone & Joint Surg. N. S. 30:581 (Nov.) 1948.

ADAPTED WHEELCHAIR FOR ABOVE-KNEE AMPUTEES *

(A Preliminary Report)

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and
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WOOD, WISCONSIN *

Flexion contractures in the hips of above-knee amputees have been one of the major problems confronting orthopedists, brace makers, and, more recently, physiatrists. Correct fitting for above-knee prostheses requires free hip motion. The fitting of such prostheses has been impossible in many cases because of hip flexion contractures. Flexion contractures often result from continuous use of the conventional wheelchair. To prevent such hip contractures, a simple wheelchair attachment, interchangeable for right or left amputees, has been devised. This attachment may also be useful for the correction of contractures already developed. This device can be attached easily to any conventional collapsible wheelchair. It can be removed to reconvert the chair for normal use

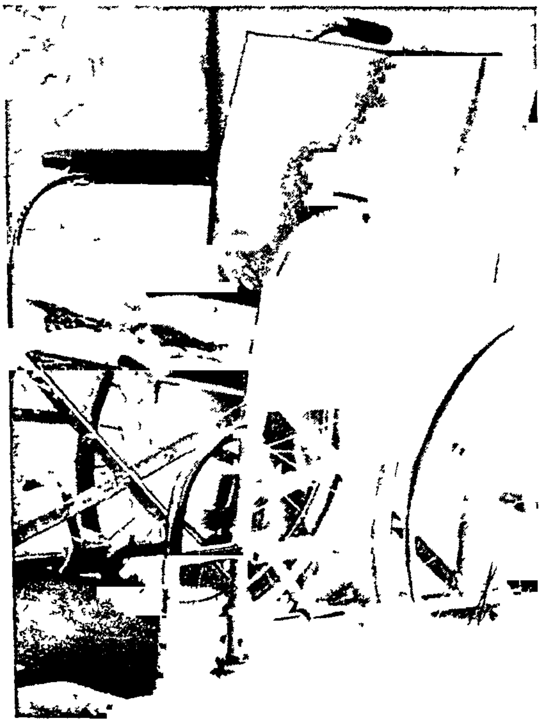

Fig 1

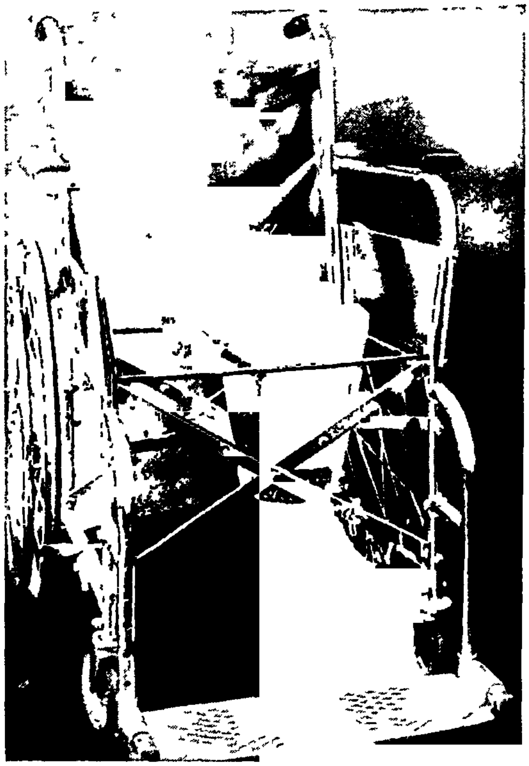

Fig 2

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* Submitted by the Physical Medicine Rehabilitation Service, Veterans Administration Center, Wood, Wisconsin Technical assistance was given by Henry V Grabowski, Manual Arts Therapist, Veterans Administration Center, Wood, Wisconsin

Description: The socket is the large size from a conventional above-knee prosthesis. An insert can be added to the socket to conform to the size of any stump. The bucket adjustment consists of two aluminum brackets fastened to the wooden socket. Two wing nuts control the maximum and mini-

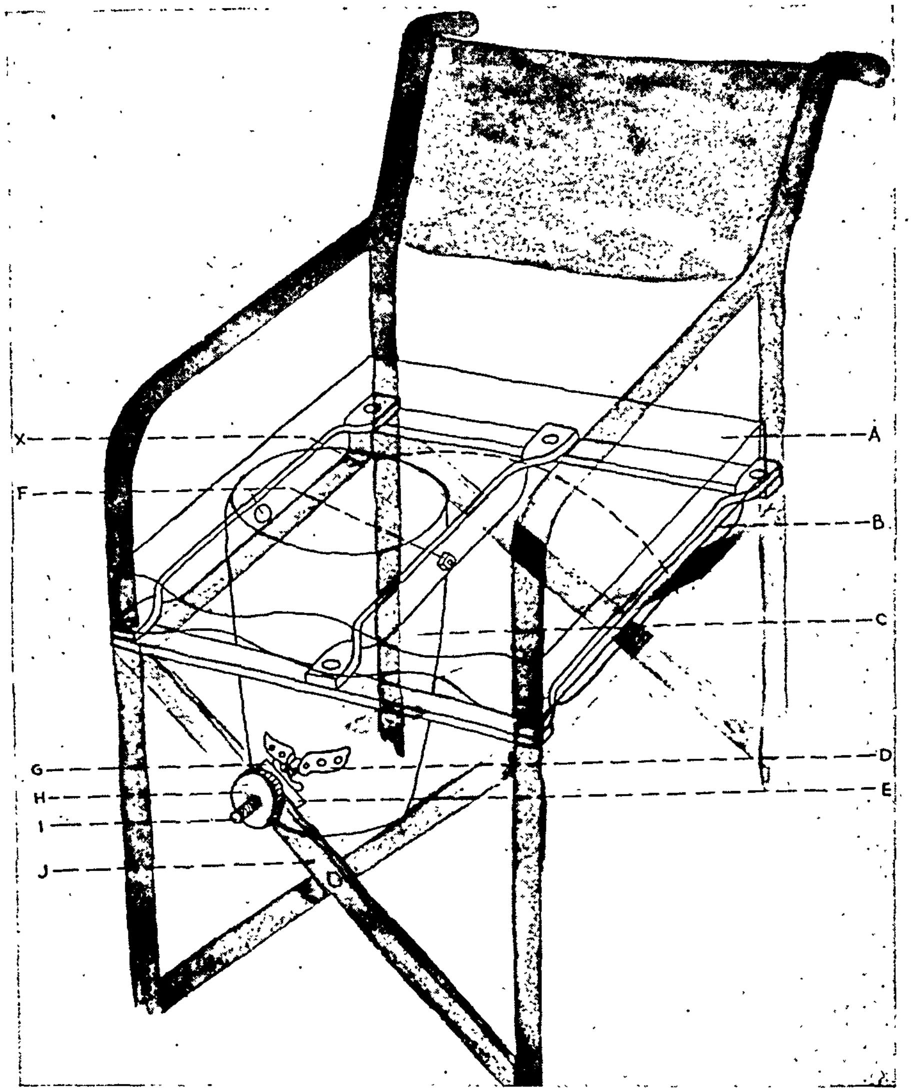

Fig. 3.

Key to Fig. III

A) Twin face saddle seat
B) Socket suspension frame
C) Wooden socket
D) Bracket for adjustment rod
E) Fortification block
F) Carriage bolts
G) Inside wing nut for adjustment rod
H) Disk with knurled edge
I) Adjustment rod
J) Hollow cross bar
X) Tubular seat support of wheelchair and a large socket from conventional knee prosthesis

mum adjustment of the socket on the threaded rod. The rod passes through a ⅜ inch hole in the wheelchair cross brace, both front and back. Since the cross brace is of hollow construction, the hole is fortified with a block, ¼ x 1 x 1½ inches, of cold roll steel. When the wing nuts are removed from the adjustment rod, the frame with the socket can be reversed on the wheelchair from right to left positions.

A special twin-face saddle seat, 2¾ x 17 x 18 inches, lined with sponge rubber and covered with imitation leather, is placed over the entire attachment. The hole in the seat is large enough to allow for ¼ inch clearance around the bucket. A padded back is used to maintain proper position.

This adjusted chair has been a valuable adjunct to our Physical Medicine Rehabilitation program for above-knee amputees in preventing and correcting flexion contractures of the hips. Contractures of 10 to 30 degrees have been corrected through the use of the chair. It was possible to get patients out of bed earlier. Some of these patients would have been required ordinarily to remain in bed for long periods while traction was being applied by conventional means. Patients were placed in the chair for periods varying from thirty minutes to five hours per day. Of the five patients treated to date, all have been approved by the physiatrist for fitting.

Conclusion and Summary

1. An attachment for a wheelchair to be used in the prevention and correction of flexion contractures of the hips in above-knee amputees has been devised and is described herein.
2. Contractures of 10 to 30 degrees have been corrected.
3. In cases handled to date this adjusted wheelchair has been a valuable adjunct to the Physical Medicine Rehabilitation Service, Veterans Administration Center, Wood, Wisconsin.

30th Annual Session

SCIENTIFIC EXHIBIT SPACE

Requests for applications for scientific exhibit space in connection with the 30th Annual Session to be held at The Roosevelt, New York, New York, August 25, 26, 27, 28, 29, 1952, are being received. Address all communications to the American Congress of Physical Medicine, 30 North Michigan Avenue, Chicago 2.

A DEVICE TO FACILITATE STANDING FROM A SITTING POSITION: FOR PATIENTS WITH SEVERE RESIDUALS OF POLIOMYELITIS *

LESLIE BLAU, M.D.†
JOSEPH PHILLIPS, B.P.E.†
and
DONALD L. ROSE, M.D.‡

For the many patients with severe muscular weaknesses as a result of an attack of poliomyelitis of the paralytic, spinal-type,[1] simple activities of daily living are often impossible to attain except in the sense of their accomplishment as a technical feat. The device to be described has proved to be extremely useful in such a patient who could not stand from a sitting position without its help.

The Device

The device is composed of three main sections as shown in figures 1 and 2:

1. Adjustable horizontal bars.
2. Parallel bars.
3. A seat that fits between the parallel bars.

In using the appliance the patient moves his wheelchair up to the parallel bars and sets its brakes. He locks the right brace in extension at the knee

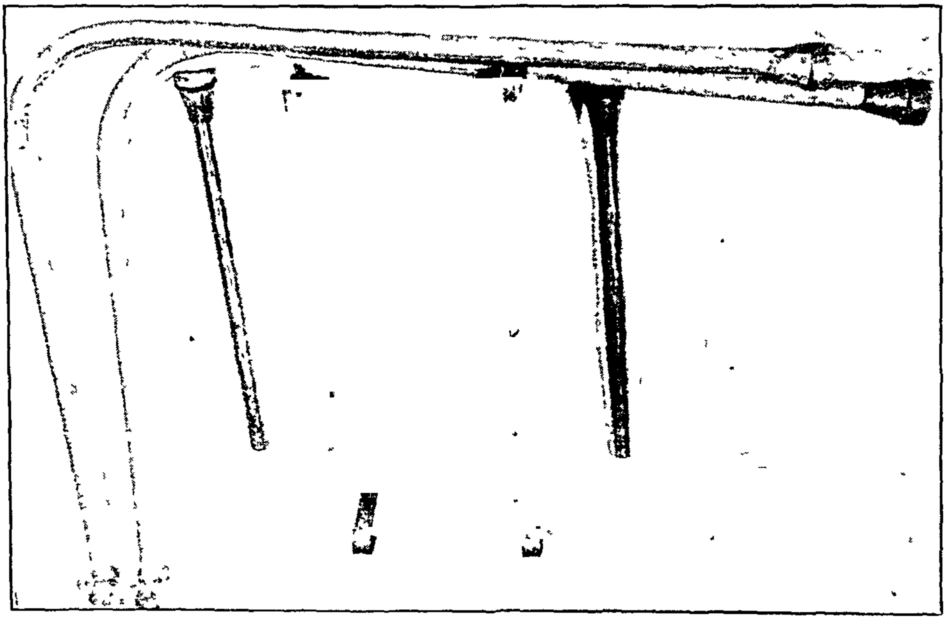

Figure 1 — Layout of units prior to assembly showing the parallel bars with the ¾ inch and 1 inch T's and ¼ inch studs, assembled. Seat with ¼ inch wing bolts in place.

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* Published with permission of the Chief Medical Director, Department of Medicine and Surgery, Veterans Administration, who assumes no responsibility for the opinions expressed or the conclusions drawn by the authors.
† Physical Medicine Rehabilitation Service, Veterans Administration Center, Wadsworth, Kansas.
‡ University of Kansas Medical Center, Kansas City, Kansas.

and flexes the left leg to 90 degrees. The right forearm is placed in pronation on the seat, the hand grasping its forward edge. The left hand is placed on the arm rest of the wheelchair, the forearm flexed to 90 degrees, the shoulder extended and the scapula depressed and adducted. Figure 3 illustrates this position.

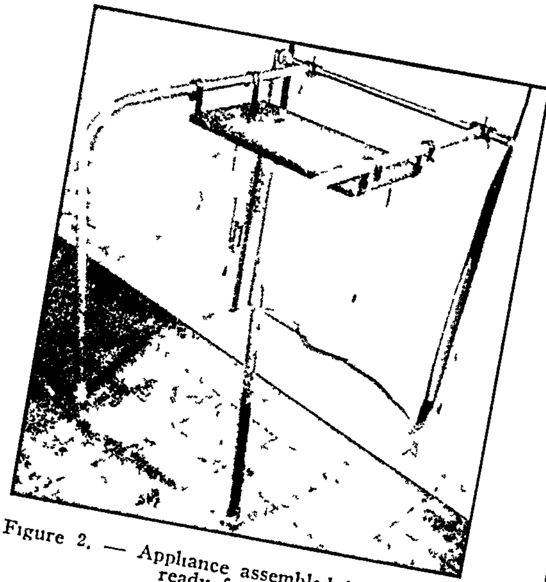

Figure 2. — Appliance assembled in doorway, ready for use.

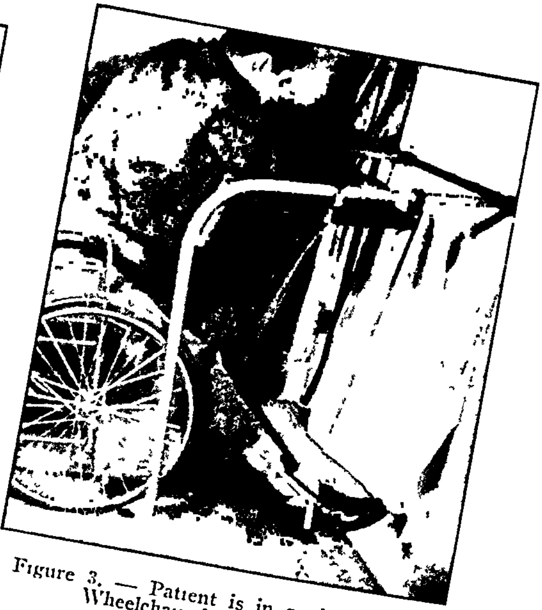

Figure 3. — Patient is in ready position Wheelchair brakes are set

By the simultaneous and coordinated use of the shoulder girdle muscles and forearm extensors on the left and the finger, forearm and arm flexors on the right, the patient, by levering forward from the seat, assumes a position of resting his trunk on the device seat as shown in figure 4. He then releases

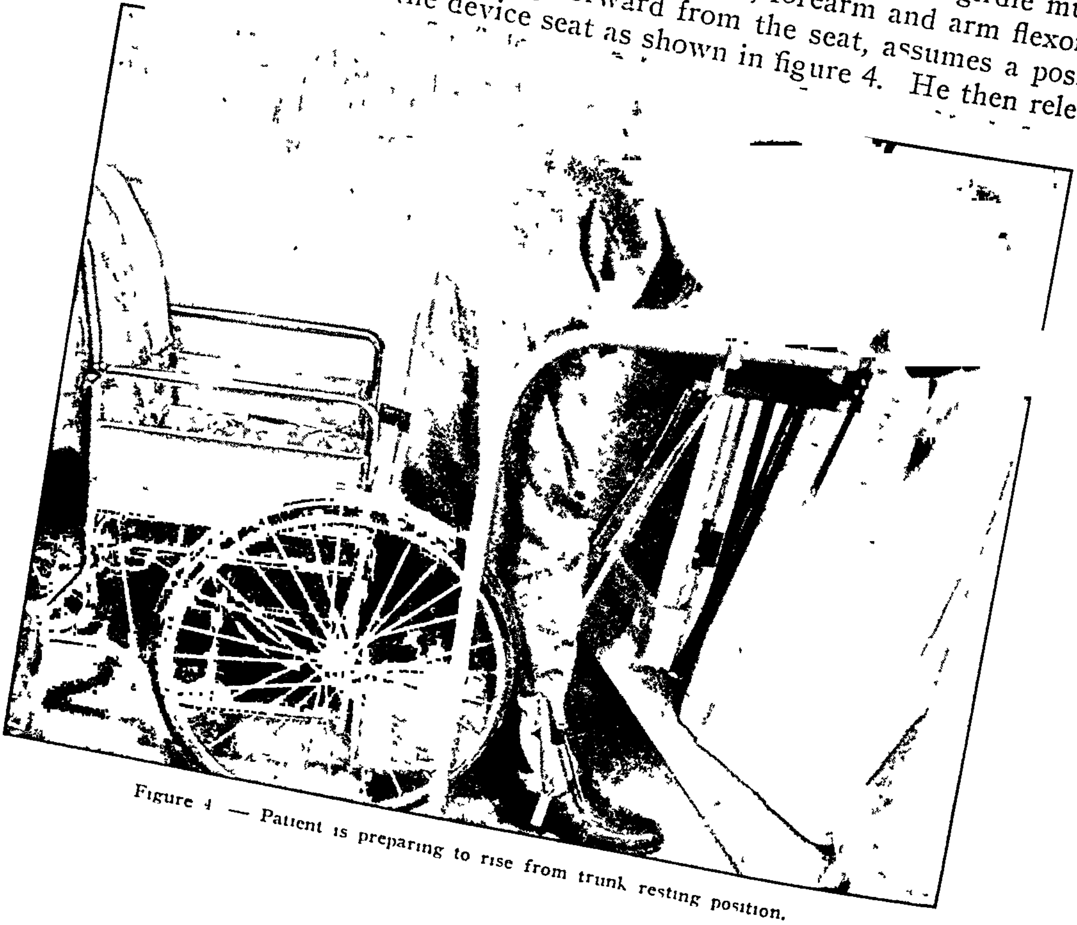

Figure 4 — Patient is preparing to rise from trunk resting position.

his hold on the seat, transferring his hands first to the horizontal bar and then to the parallel bars.

By coordinate action of the triceps, erector spinae and shoulder girdles to extend the torso, he is able to assume the erect position as shown in figure 5. The patient may now turn, push his wheelchair away with his crutch and is ready to walk. See figure 6 for this position.

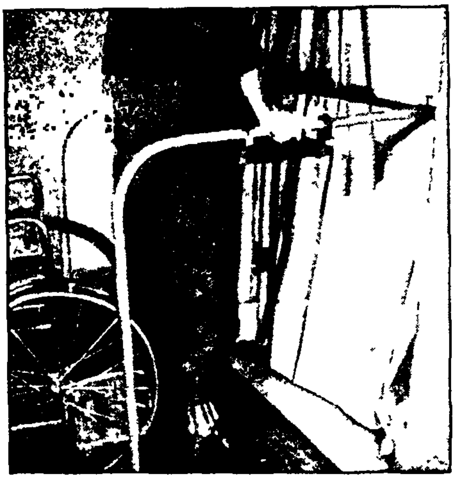

Figure 5. — Patient is in the erect position.

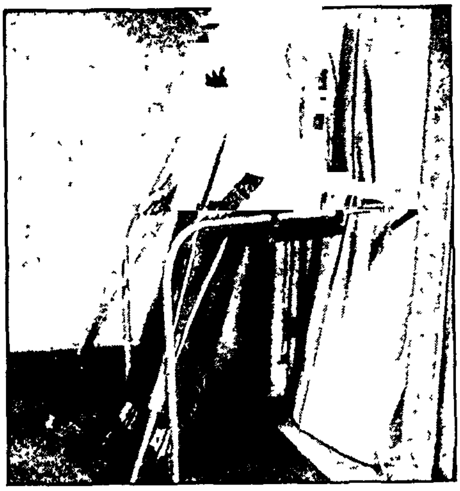

Figure 6. — Patient is ready for ambulation.

Material and Fabrication

ADJUSTABLE HORIZONTAL BAR —

Materials needed:
1 piece ¾ in. standard black pipe, 24 in. long
1 piece 1 in. thinwall conduit, 25 in. long
1 ⅜ in. nut of cold rolled steel
1 ⅜ in. bolt of cold rolled steel, 20 in. long
1 piece ¾ in. cold rolled steel, 3 in. long
2 crutch tips, suction type, No. 18

Fabrication: The ⅜ in. nut is welded into the inside of the ¾ in. pipe, flush with the open end. The opposite end of the pipe is fitted with a crutch tip. The bolt is welded into the inside of the conduit, one inch from the end. This allows four inches for inserting the piece of ¾ in. cold rolled steel, 3 in. long. This piece of steel is fitted with a crutch tip and its free movement in the conduit permits tightening the bar when the crutch tips are in contact with the door jamb.

PARALLEL BARS —

Materials needed:
2 pieces of 1 in. thinwall conduit, 7 ft. long
1 T pipe fitting, 1 in. x 1 in. x ¾ in.
1 ¾ in. standard T pipe fitting
2 ¾ in. pipe nipples, 2 in. long, threaded on one end
2 wooden plugs, ¾ in. x 2 in. long
2 crutch tips, suction type, No. 18
2 ¼ in. wing studs, 2 in. long

Fabrication: The ¾ in. pipe nipples are threaded into the stem ends of the T's and the unthreaded ends are inserted into the ends of the thinwall conduit parallel bars. A rivet is used at this juncture to secure the nipple to the conduit. The threads on the bodies of the T's are removed to allow a smooth sliding action on the horizontal bar. The bodies of the T's are tapped for a ¼ in. wing stud, 2 in. long to serve as a set to keep the parallel bars from sliding on the horizontal bar, and to hold the horizontal bar ajar in the door jamb. The two pieces of conduit, 7 ft. long, are bent to conform to the height of the patient. The wooden plugs are inserted into the ends of the conduit next to the floor and crutch tips are fitted to these to prevent slipping and damaging the floor.

SEAT —

Materials needed:
1 piece ¾ in. plywood, 2 ft. long and 1 ft. wide
4 hanger irons, ⅛ in. flat steel, 12 in. long x 1 in. wide, bent on one end to conform to the shape of the conduit parallel bars
8 3/16 in. wood screws, ¾ in. long
4 wing bolts with nuts, ½ in. x 2 in.
Scrap Duran or Vinyl for upholstery

Fabrication: Two 3/16 in. holes are drilled in each of the four hanger irons and mounted to the plywood with 3/16 in. screws, ¾ in. long. The U section of the hangers are drilled for wing bolts ½ in. x 2 in. long. Tightening the wing bolts secures the seat to the proper position on the parallel bars. Scrap Duran or Vinyl is tacked to the plywood for upholstery.

ASSEMBLY —

The device is assembled in the doorway by sliding the T's of parallel bars over the corresponding horizontal bars. The bolt of one-half of horizontal bar is turned into the nut of the other half until the bar becomes short enough to insert the crutch tips into the door jamb. A reverse turning then brings the bar ajar with the jamb. The wing studs on the bodies of the T's are then tightened to make the parallel bars firm and keep the horizontal bar from loosening. The seat is set on the parallel bars and the wing bolts are tightened.

All details of this assembly could be easily accomplished by the patient.

Summary

An adapted device has been described which enabled a patient with severe muscular weaknesses, the residual of poliomyelitis, to assume the erect position independently without additional aid.

The authors are grateful to Mr. William W. Russell, Executive Assistant, Physical Medicine Rehabilitation Service, for his contribution by providing us with the photographs and to Mr. Andrew Cates, Chief Orthotist at Wadsworth Veterans Administration Center, for the fabrication of the device. We are also thankful to Mrs. Virginia Cummins for her untiring cooperation in the preparation of the manuscript.

IMPORTANT NOTICE

Nominations of candidates for Gold Key Awards may be made by any member of the Congress. A nomination should include a brief statement of the achievements of the candidate and the reasons for his consideration by the committee appointed to select the recipients of the award. Nominations should be sent to the Executive Secretary of the American Congress of Physical Medicine by May 1, 1952.

ARCHIVES of PHYSICAL MEDICINE

OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL MEDICINE

.˙. EDITORIAL .˙.

AMERICAN BOARD OF PHYSICAL MEDICINE AND REHABILITATION

The next examinations for the American Board of Physical Medicine and Rehabilitation will be held in Chicago, June 8 and 9, 1952. The final date for filing applications is March 31, 1952. Applications for eligibility to the examinations should be mailed to the Secretary, Dr. Robert L. Bennett, Georgia Warm Springs Foundation, Warm Springs, Georgia.

DIATHERMY RULES AND THE PHYSICIAN

A large number of physicians using short-wave diathermy equipment manufactured prior to July 1, 1947, are confronted with the decision as to what to do after June 30, 1952, when new rules and regulations of the Federal Communications Commission relating to medical service become effective. For several years the physicians and manufacturers of diathermy equipment were defending their rights to manufacture, sell and use such equipment in treating human ills, and the radio communications services were protesting the interference caused by its use with resulting interruption of radio communications and occasional jeopardy to life. The FCC, with the cooperation of the different groups concerned, was able to work out a solution to this vexing problem. Under certain conditions operation of existing diathermy equipment was possible for five years. This period has now nearly elapsed. A physician whose equipment does not now operate at one of the prescribed frequencies, 13,560, 27,120 or 40,680 kilocycles (within prescribed limits), must make his decision as to operation after June 30, 1952, from the following possibilities:

1. He may discard his old machine and purchase one meeting the new regulations.
2. He may have his treating room shielded and continue use of his old machine if it is of a suitable type. Otherwise the machine must be rebuilt, for use in a shielded room.
3. He may have his machine rebuilt to comply with the new requirements.
4. He may discontinue giving diathermy treatment.

These possibilities are discussed in order:

(1) A simple solution entails the expenditure of several hundred dollars in the procurement of a diathermy generator which has had type approval by the FCC. The Council on Physical Medicine and Rehabilitation of the American Medical Association maintains a list of accepted manufacturers and models of diathermy generators found to give adequate heating for clinical use. The prospective purchaser thus has two organizations with which he can check the merits of a given machine before investing. It is usually possible to purchase a new machine of the same make as previously used, so that changes in techniques of operation will not be great This feature is important from the standpoint of dosage and the securing of desired clinical results.

(2) There may be some physicians who prefer to continue using their old equipment. In such a case, if the machine is provided with a rectified

and filtered power supply and power line filters, the treatment room must be shielded. This is an expensive and somewhat time-consuming operation. There are two methods which may be used: (a), covering the walls, floor and ceiling with a thin metallic sheet to form a continuous metal surface; (b), construction of a screen wire or metal cubicle within the treating room to contain the diathermy generator, patient treating table, and other accessories. In either case the technical details require the services of a consulting radio engineer and application by service men trained in installation of such devices. Screened rooms and special power line filters are on the market which can readily be assembled in a desired location. Such facilities, however, in their present unappealing style seem inappropriate for a physician's office. Nevertheless, this appears to be the only manner in which diathermy generators can legally operate at other than assigned frequencies. After installation of a shielded room, and every three years thereafter, its effectiveness must be certified by a competent engineer. The cost of the installation and certification of a shielded room may be several times that of a new generator. It is, therefore, unlikely that there will be many calls for this type of service.

(3) The physician may perhaps be justified in thinking that his machine can be rebuilt without too great expense, in order to comply with the new requirements. This would not be economically feasible unless a large number of machines were involved. It is unlikely that the individual physician would save much money by such an arrangement, even if it should be possible.

(4) The physician may elect to discontinue the use of diathermy because of the extra expense involved in meeting the requirements of the law. This may be the decision of a limited number of physicians who have not made much application of this form of therapy. The situation applies also to hospitals and rehabilitation centers. These institutions usually operate on a limited budget, such that when operation of present diathermy equipment becomes illegal, they will be forced to suspend these curative methods until new equipment can be purchased. There are instances where a diathermy generator has been presented as a memorial gift, but unfortunately these must also be discarded.

From the foregoing discussion it is apparent that the most economical procedure for the physician using diathermy equipment is to obtain apparatus which has had type approval by the Federal Communications Commission.

E. L. HALL, E.E.,
National Bureau of Standards,
Washington, D. C.

INDICATIONS FOR DIATHERMY

The preceding editorial by E. E. Hall calls attention to the fast approaching deadline when most of the diathermy equipment now in use will have to be replaced, rebuilt, or shielded. Some of us have procrastinated and have done little or nothing toward procuring approved equipment. Perhaps some might even prefer to accept Hall's fourth alternative and discontinue the use of this modality altogether. It might be well to review briefly the therapeutic indications for diathermy to ascertain how essential it is in the armamentarium of physical medicine.

About two years ago, Martin and Erickson[1] in an article written for the Council on Physical Medicine and Rehabilitation enumerated the following indications for diathermy with some qualifications: (1) rheumatoid arthritis, (2) osteoarthritis, (3) bursitis, (4) tenosynovitis, (5) fibrositis and myositis, (6) sprains and strains, (7) fractures, (8) neuritis, (9) peripheral vascular disease, (10) sinusitis, (11) otitis media, (12) pleurisy, (13) diverticulitis, (14) iritis and uveitis.

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[1] Martin, G. M., and Erickson, D. J.: Medical Diathermy, J. A. M. A. 142:27 (Jan. 7) 1950.

The value of diathermy in rheumatoid arthritis is limited by the fact that the disease usually is polyarticular and the treatment of many joints is too time consuming and too fatiguing for the patient. Furthermore, other forms of heat give as good or better results. In osteoarthritis, however, it is the best form of heat available and often gives lasting symptomatic relief In view of the high incidence of this disease in older patients; the therapeutic importance of diathermy is greatly enhanced.

The writer has found that diathermy usually accentuates pain in acute bursitis and prefers the ice pack in the treatment of this condition.[2] In chronic bursitis it produces satisfactory results if treatment is persistently pursued. In the writer's experience diathermy is more effective treatment for tenosynovitis than other forms of heat. Moist heat gives better muscular relaxation than diathermy in fibrositis and myositis and is better preparation for massage in these conditions. It is a satisfactory form of heat in sprains after all danger of hemorrhage into local tissue is past; certainly not earlier than twenty-four hours after the injury. The use of diathermy in the treatment of fractures is somewhat controversial and other forms of heat are probably to be preferred.

Diathermy is likely to accentuate pain in neuritis, but is of considerable value in the radicular type of peripheral nerve pain, such as certain cases of sciatica and intercostal neuralgia. Diathermy should not be used locally in peripheral vascular disease of the lower extremities, but may be applied to the upper thigh or lower trunk to produce reflex dilatation of vessels in the limbs.

Diathermy is of value in giving symptomatic relief in acutely congested sinuses associated with the common cold provided adequate drainage is obtained by means of a local vasoconstrictor. In chronic sinusitis, its value is limited. Short-wave diathermy may be used for pain relief in otitis media in conjunction with other indicated therapy.

In subacute and chronic pelvic inflammatory disease, diathermy is an important method of treatment. Short-wave diathermy may be effectively applied by means of the pancake coil. It is exceedingly effective treatment for the relief of pleural pain, but should not be used if the pleurisy is of tuberculous origin. It has been reported to be of benefit in the treatment of diverticulitis in conjunction with other therapeutic procedures.

Diathermy may be used in the treatment of iritis and uveitis, if applied with caution. Experimental overheating of the lens has produced opacities.[3-4]

There are certain contraindications to diathermy which space will not permit us to consider. The indications mentioned in the preceding paragraphs show that diathermy is an important method of heat therapy. It is, however, primarily an office or treatment room procedure which can be utilized only occasionally in the patient's home. Nevertheless, the physician who has had diathermy equipment available and is familiar with its use, would find it difficult to do without it.

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2. Moor, F. B.: The Treatment of Acute Subdeltoid Bursitis, Med. Arts and Sciences 4:56, 1950.
3. Richardson, W. A.; Duane, T. D., and Hines, H. M.: Experimental Lenticulor Opacities Produced by Microwave Irradiations, Arch. Phys. Med. 29:765 (Dec.) 1948.
4. Daily, L., Jr.; Wakim, K. G.; Herrick, J. T., and Packhill, E. M.: Effects of Microwave Diathermy on the Eye (Abstr.), Am. J. Physiol. 155:432 (Dec.) 1948.

MEDICAL NEWS

Members are invited to send to this office items of news of general interest, for example, those relating to society activities, new hospitals, education, etc. Programs should be received at least three weeks before the date of meeting.

Personals

Dr. **George D. Wilson** has been elected the new Praetor of Southeastern Pronice of the Phi Beta Pi Medical Fraternity, including the states of Kentucky, Tennessee, North and South Carolina, Georgia, Alabama, Mississippi and Florida. Dr. Wilson delivered lectures on recent developments and treatments by Physical Medicine to faculty and students at the University of Alabama Medical School, Birmingham, Ala. He delivered an essay on "Post Injection Paralysis" to the Section of Physical Medicine Rehabilitation of the Southern Medical Association held at Dallas, Texas.

Dr. **George Morris Piersol** is Editor-in-Chief of the only complete medical and surgical reference library in one single unit, THE CYCLOPEDIA OF MEDICINE, SURGERY, SPECIALTIES.

Dr. **Michael M. Dacso**, Goldwater Memorial Hospital, New York, N. Y., recently appeared before the New York Joint Legislative Committee on "Problems of the Rehabilitation of the Aged."

The February meeting of the Pennsylvania Academy of Physical Medicine and Rehabilitation was held at the Philadelphia County Medical Society. The following topics were presented: "Recent Trends in Industrial Medicine," by Dr. Philo W. Rugh and "Problems in Rehabilitation of the Aphasic Hemiplegic," by Dr. **Samuel Sverdlik.**

New Journal

Dr. Harry D. Bouman of the University of Wisconsin Medical School is editor of a new professional publication, "American Journal of Physical Medicine."

Dr. Bouman came to the University in 1947, after two years on the Northwestern faculty. He also has taught at Oberlin college, Ohio, and the University of Rochester, N. Y. A native of Holland, he received his medical degree from the University of Amsterdam.

Bill H. 1059 Introduced

Massachusetts — Bill amends law relating to physical therapy — proposes to permit the licensing of persons without examination if they were engaged in the active practice of physical therapy in a competent manner for three (3) years immediately preceding November 30, 1951.

Accepted Devices

Beck-Lee Cardi-All Electrocardiograph. — Manufactured by Beck-Lee Corporation, 630 W. Jackson Blvd., Chicago 6, Ill., device is a direct-writing instrument in which an electrically heated stylus traces on heat-sensitive paper strip. The Council on Physical Medicine and Rehabilitation voted to include the instrument in its accepted list.

Mineralight, Model SL 3660. — Manufactured by Ultra-Violet Products, Inc., 145 Pasadena Ave., South Pasadena, California, lamp is a small source of ultraviolet radiation useful for examination of small specimens of material, but especially designed for use in medical diagnosis. The Council on Physical Medicine and Rehabilitation voted to include the device in its accepted list.

Kinocycle. — Manufactured by Kinocycle Company, 99 Prospect Hill Ave., Summit, N. J., device is stationary bicycle on which user experiences reciprocating motion of handlebars and seat as well as usual rotating pedal movements. It offers active and passive movement. The Council on Physical Medicine and Rehabilitation voted to include the apparatus in its list of accepted devices.

Southeastern Section Meets at Dallas

The Southeastern Section of the Southern Medical Association met at Dallas, Texas, recently. The following officers were elected: Roy A. Dawson, Chairman; Sedgwick Mead, Vice-Chairman, and Edward Krusen, Jr., Secretary.

Training in Treatment of Arthritis

The National Institute of Arthritis and Metabolic Diseases, Bethesda 14, Md., has established a program of clinical traineeships in the prevention, diagnosis and treatment of arthritis and the metabolic diseases. The purpose is to improve the competency of physicians in the treatment and rehabilitation of arthritis patients. For additional information, write to the Chief of Extramural Programs at the Institute.

Clifford H. Arnold

It is with regret that we announce the death on January 26 of Dr. Clifford H. Arnold, Tucson, Arizona. Dr. Arnold was a Congress member for many years. His death resulted from coronary occlusion.

BOOK REVIEWS

THE BIOLOGY OF HUMAN STARVATION. By *Ancel Keys, Josef Brozek, Austin Henschel, Olaf Mickelsen,* and *Henry Longstreet Taylor,* with the assistance of (*Ernst Simonson, Angie Sturgeon Skinner,* and *Samuel M. Wells.* Volumes I and II. Cloth. Price of Volume I, $12.00. Price of Volume II, $12.00. Pp. 1385. The University of Minnesota Press, Minneapolis, Minnesota, 1950.

This magnificent pair of volumes represents a most thorough-going study of undernutrition done with the help of a group of conscientious objectors during the second World War. The fortitude of these men can hardly be appreciated by anyone who has not witnessed the unrelenting schedule of work, tests, and strains of all descriptions involved in such research, but suggestions may be obtained from the photographs on pages 1119 to 1126, and from descriptions of the mental state of the subjects (Pages 880 to 904).

Volume I is divided into four sections which discuss, respectively, the historical, morphological, biochemical, and physiological aspects of the experiment; Volume II summarizes the psychological aspects, takes up special problems including hunger edema, contains the appendixes including a discussion of wartime rations, and gives detailed tabulations of the original data. Of great medical significance is the chapter on the rate of growth of cancers during starvation, and of special interest to the physiatrist are the sections on circulation and cardiac function, on fainting and the cardiovascular response to posture, on fitness tests, and on anthropometric procedures. The whole subject has an immediate personal interest to every intelligent reader, and the two historical chapters (pages 3 to 17 and 1247 to 1252) are a terrible catalogue of suffering from which surely humanity ought to learn. Extremely well written, documented, and indexed, these volumes deserve to be in every medical library.

ENZYMES AND ENZYME SYSTEMS: Their State in Nature. Edited by *John T. Edsall,* M.D., Associate Professor of Biological Chemistry, Harvard University. Pp. 146. Price, $2.75. Harvard University Press, Cambridge, Mass, 1951.

This is a text which all investigators in the basic medical sciences will wish to have in their libraries. In it are brought together a summary of recent advances in the study of enzymes from the laboratories of the universities of Chicago, Wisconsin, Utah, Pennsylvania, Harvard, and the Medical Nobel Institute in Stockholm. This was made possible by the organization of seminars for workers in the field by the Harvard University Laboratory of Physical Chemistry related to Medicine and Public Health, which are reported in part in this publication.

THE 1950 YEAR BOOK OF ENDOCRINOLOGY (January 1950 - January 1951). Edited by *Willard O. Thompson,* M.D., Clinical Professor of Medicine, University of Illinois College of Medicine; Attending Physician (Senior Staff), Henrotin Hospital; Attending Physician, Grant Hospital of Chicago. Cloth. Price, $5.00. Pp. 499 with illustrations. The Year Book Publishers, Inc., 200 East Illinois Street, Chicago 11, 1951.

This is the first volume of Year Books on Endocrinology. With the ever increasing knowledge in this special field, it became necessary to devote a separate volume to the glands of internal secretion. The large number of articles on the pituitary and adrenals alone would justify a separate book. The knowledge of the functions of both glands has increased tremendously and the interrelationship between the two glands has assumed a far greater importance because of the dramatic effects of cortisone and ACTH. About one-half of the book is concerned with the latest information about the pituitary and the adrenal.

The review of the work for the other glands is reported. Much space is given over to the use of the radioactive iodine in the thyroid field. The significant developments in testicular and ovarian pathology and physiology have increased, as evidenced by the number of articles about these two glands.

The book is edited by Dr. Willard Thompson. His editorial comments are excellent and materially help evaluate the various articles.

MEDICAL TREATMENT. Principles and Their Application. By *Geofrey Evans,* M.D., F.R.C.P. The C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, Mo.

This book contains a great quantity of wisely selected medical information. The sections on infectious, tropical, metabolic and gastrointestinal diseases are especially well done. The section on cardiovascular disease is also well done except possibly the section on peripheral vascular disease in which "Raynaud's Disease" and "Raynaud's Phenomenon" needs clarification. Anticoagulant therapy is becoming increasingly more popular and it appears that the section devoted to anticoagulants is too brief. It omits contraindications to therapy and the recommended therapy for dicumarol intoxication, consisting of 4 mgm. of Vitamin K, intravenously, together with a fresh blood transfusion, cannot be considered the treatment of choice.

The book appears to be one of the better general medical references and is recommended for physicians engaged in a busy general practice.

THE MANAGEMENT OF FRACTURES, DISLOCATIONS AND SPRAINS. By *John A. Key*, M.D., and *H. E. Conwell*, M.D. Fifth Edition. Cloth. Price, $15.00. The C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, Mo., 1951.

The fifth edition of this well-known textbook on fractures, dislocations and sprains is a definite improvement over its preceding fourth edition published in 1946. The grade of paper is better and the type has been changed to make for easier readability. The illustrations, the majority of which are the same, are of over-all better reproduction, and although a considerable number of the less essential illustrations have been deleted there is an approximately equal number of new illustrations showing some of the more recent changes in the treatment of bony injuries. The actual bulk of the volume is approximately the same as the preceding edition. There have been several significant changes in the text of a specific nature. The chapters on Workman's Compensation affecting fracture cases and on medical legal aspects of fracture cases have been eliminated from the new volume. Certain forms of therapy have been added, particularly intramedullary fixation of fractures of both the shaft of the femur and of the shaft of the tibia. In the treatment of infection and the prophylaxis of infection in open or compound fractures, there has been a transition from the use of sulfonamides to the use of penicillin and the steps in the technique of treatment of open and compound wounds is given in greater detail. Although some of the methods of treatment for specific fractures which are outlined are no longer in common use in many of the teaching centers, their inclusion in the volume is still of considerable importance. Involving, as they do, basic principles which rarely change they make for a clearer understanding of the particular technique in vogue at the present, since they serve to bring the student up through the various stages in the process of treatment of these specific fractures, thereby giving them a clearer and better understanding of the problem as a whole. There are no forms of treatment advocated which are not entirely acceptable to present-day knowledge of orthopedics. This textbook remains one of the classics in the instruction of not only students and residents, but of the general practitioner and the traumatic surgeon as well. It can only be highly recommended for any one whose practice involves the treatment of acute bony injuries.

AN INTRODUCTION TO MATERIA MEDICA AND PHARMACOLOGY. By *Elsie E Krug*, R.N., M.A., Instructor in Pharmacology and Anatomy and Physiology, St. Mary's School of Nursing, Rochester, Minn., and *Hugh Alister McGuigan*, Ph.D., M.D., Professor Emeritus of Materia Medica, Pharmacology and Therapeutics, University of Illinois, College of Medicine, Chicago. Cloth. Price, $4.25. Pp. 612 with 37 text illustrations and 10 color plates. The C. V. Mosby Company, 3207 Washington Blvd., St. Louis, 1951.

This textbook is intended to introduce the student nurse to the scientific basis of the use of drugs. Opening chapters discuss general problems of preparation, dosage, and administration; another group of chapters are devoted to pharmacodynamics and toxicology. Succeeding units take up in order the pharmacology of different systems of the body, chemotherapy, metabolism and nutrition, and serums and vaccines, and closing chapters are devoted to a history of materia medica and a summary of drug legislation. The book offers a wealth of information on these subjects, the material is extremely up-to-date, and the facts are generally presented in clear and interesting fashion.

With many other contemporary textbooks this one shares certain weaknesses that deserve comment. Many of these have to do with semantics, a growing science about which textbook writers ought to inform themselves. They should be on guard against using the same word in different senses on the same page (e. g., "pharmacy" on page 562). Sections on history should not repeat all-or-none statements that could not possibly be true ("The doctors were all priests . . .", page 557). The difficulty of identifying the drugs and diseases named in ancient manuscripts with those extant today should be brought to the attention of the student (page 556). Glossaries should not confuse the particular with the general (Aerosol. A medicine mixed with air . . .", page 581). A group should not be confused with part of itself ("parasympathetic drugs" for "drugs that paralyze the parasympathetics," page 269). These examples are pointed out because similar flaws, often much more serious, are so often to be found in current textbooks in the medical field, and because a disregard for semantics so often increases the difficulties of a student in subjects that are baffling enough to begin with.

The book contains an immense amount of valuable information, is very readable, has some attractive illustrations, and is well indexed. It can be highly recommended to the classes for which it is intended.

PHYSICAL MEDICINE ABSTRACTS

Fractures of the Metatarsals and Tarsals. R. J. Bennett.

Indust. Med. & Surg. 20:423 (Sept.) 1951.

Satisfactory results have been obtained in treating 631 cases of fractures of the metatarsal and tarsal bones. Both the frequency and severity of fractures of the bones of the feet are less than ten years ago, owing to intensive safety programs and protective devices for the feet. Prompt reduction is the most important step in the treatment of fractures of the tarsals and metatarsals Adequate fixation is imperative. In several instances, it was found that the patient was weight-bearing and walking on the metatarsal splint or cast, and in several other instances the patient did not like the treatment, so took the fixation apparatus off and returned or discarded it. Union was found in most simple fracture cases between four and eight weeks. Depending upon the amount of callus present, weight-bearing was allowed in an average of eight to twelve weeks. Once the bones were solid, physical therapy and actual use were started. In a few instances, swelling of the foot and ankle persisted throughout proper reduction and fixation, and continued to be troublesome even when physical therapy and use were started. Back to work was indicated when there was adequate callus plus response to physical therapy and use following removal of the splint. In those cases where there was a delay or failure to restore normal alignment of the fractures and the arches, prolonged temporary disability and severe permanent disability resulted. Once the splint or cast was removed from the foot, active and passive motions were carried out unless pain and too much swelling developed. By far the best therapy to restore the foot to normal function is the actual use of the foot. Massage, whirlpool bath and heat were found to be of value also and in that order.

A Foot By Pass Apparatus for Treating Fractures of the Femur. August W. Spittler, and John J. Brennan.

U. S. Armed Forces M. J. 2:1389 (Sept.) 1951.

This article describes an apparatus to improve the treatment of fractures of the femoral shaft with skeletal traction. It is accomplished by the use of a metal ring placed in the line of traction over the foot. This causes the traction to by-pass the foot. Early institution of knee movement by conversion of the Pearson attachment to an exerciser is facilitated by the use of the metal ring by-pass of the foot. It helps to prevent ankylosis of the knee. The patient is able to extend the knee completely with full clearance for the foot at any time. Using full extension of the knee as the resting position in the intervals between the exercise periods also is facilitated by the use of the ring. Conventional positional foot splints to prevent equinus contracture readily can be used with the metal ring.

Shoulder Girdle Dysfunction Following Thoracoplasty Combined With Partial Scapulectomy. Harry B. Doppelt, and Jacob Goldberg.

J. Thoracic Surg. 21:6 (June) 1951.

These authors have made a study of skeletal and muscular function changes resulting from thoracoplasty operations on a group of twenty-three patients over a two year period. In a previous paper they reported on scoliosis with concomitant changes in skeletal relationships of the head, neck and shoulders on the operated side, the thorax and pelvis. In this paper they report on skeletal deviations and changes of muscular function of the shoulder girdle on the operated side. It includes patients who have had thoracoplasty and/or partial scapulectomy. The study is based on roentgenograms of the scapula, goniometric measurements, and clinical examinations. Thoracoplasty patients showed an antero-medial displacement of the scapula, with some shoulder girdle elevation and increase of the scapulo-humeral angle, also changes in muscle function consisting of mild disturbance of scapulo-humeral rhythm associated either with no limitation of arm abduction or with limitation of 15 to 20 degrees. Scapulectomy patients showed the same changes but to a greater extent, especially in increase of the scapulohumeral angle and restricted abduction of the humerus. Factors causing disturbance of scapulohumeral rhythm, increased scapulohumeral angle, and limitation of shoulder girdle function are stated to be: the particular muscles affected by surgery, the patients' personalities, and the strength of the muscles prior to surgery.

Radioisotopes in Medicine. Henry D. Diamond.

J. M. Soc. New Jersey 48:420 (Sept.) 1951.

In four of nine patients subjected to intensive treatment of metastatic thyroid cancer with radioactive iodine (I^{131}), definite clinical improvement occurred. Three interesting means of enhancing I^{131} uptake by previously recalcitrant metastatic thyroid cancers have been elucidated. These studies have shown that particular metastatic thyroid cancers are capable of response to thyrotrophic hormone, total thyroidectomy or thyroid destruction, and to thiouracil and prophylthiouracil. The foregoing data suggests that metastatic thyroid cancers are not autonomous completely, but are alterable by select mechanisms of normal physiology. Radiophosphorus is the agent of choice in the treatment of polycythemia vera at the present time. Comfortable survival in chronic myeloid and chronic lymphatic leukemia patients is increased by the use of radioactive phosphorus (P^{32}). Toxicity from P^{32} as manifest by radiation illness and the production of aplastic anemia is minimal and insignificant when the agents are used judiciously.

Both I^{131} and P^{32} are valuable additions to the medical sciences in the study of the pathologic-physiology and treatment of certain malignant neoplastic diseases.

Effect of Prolonged Motionless Standing on Phases of Cardiac Cycle, Stroke Volumes, and Posterior-Anterior Diameters of the Heart as Studied by the Electrokymograph. E. E. Eddleman, Jr.; Kathryn Willis, and Howard E. Heyer.

J. Applied Physiol. 4:156 (Aug.) 1951.

Prolonged motionless standing was studied with the electrokymograph. Apparent stroke volumes, posterior-anterior cardiac diameters, blood pressure and phases of the cardiac cycle were determined at approximately 3-minute intervals until syncope. There were apparently three stages in the physiologic response to motionless standing. First, there was a decrease in stroke volume and cardiac posterior-anterior diameters during the first 4 to 12 minutes, probably the result of pooling of blood in the legs. Secondly, there was a temporary rise in the stroke volume associated with an increase in posterior-anterior cardiac diameters. Third, the posterior-anterior cardiac diameters continued to increase with a decline in stroke volume until syncope ensued. The mean blood pressure was maintained until the abrupt onset of syncope.

Use of the Rocking Bed to Augment Ventilation in Patients with Poliomyelitis. Clarence W. Dail; Elizabeth Austin; O. L. Huddleston, and Albert G. Bower.

California Med. 75:15 (July) 1951.

As the first step in an attempt to clarify criteria for use of the rocking bed rather than the respirator as an aid to breathing for patients with weakness of respiratory muscle function caused by poliomyelitis, ventilation studies were done on seven patients with pronounced weakness or paralysis of the respiratory muscles. Average tidal air volume was considerably less when the patient was on the rocking bed than when he was in the respirator. Since the tidal air volume with the patient on the rocking bed represents the maximum that can be produced with the apparatus, whereas the volume in the respirator represents the patient's usual tidal air and the respirator is capable of a greater volume if necessary, it is apparent that in cases of complete paralysis of the respiratory muscles the respirator has a large margin of safety, the rocking bed none. From clinical observations made on 51 patients who were put upon the rocking bed — 23 of them early in the course of the disease and 28 after they had been ill three months or more — it was concluded that the rocking bed is contraindicated for patients who are febrile and in whom the disease is progressing rapidly, and for those with atelectasis or urinary or pulmonary infection. It must be used with extreme care in the case of patients early in the course of the disease who are not tracheotomized, because of a tendency toward increased accumulation of mucus and the danger of atelectasis. General guides were developed with regard to use of the rocking bed for patients with post-acute poliomyelitis, and somewhat different rules were drawn for use of the apparatus in cases in which there is a chronic respiratory problem. The rocking bed will give artificial respiration in cases of respiratory weakness, but will not provide enough tidal air for the patient with paralysis of the muscles of respiration.

Indications for Tonsillectomy and Adenoidectomy. Frances L. Lederer.

Postgrad. Med. 10:191 (Sept.) 1951.

For some years now, the role of the tonsil and adenoid operation in relation to poliomyelitis has been interesting but controversial. Scientific evidence and statistical analysis may be manipulated at will and serve both the pros and the cons. The problem is still in a state of flux with the medical profession on the defensive, conditioned by the opinion of a public more alarmed than informed. While all present evidence taken objectively does not prove that the operation predisposes to the disease, there is some that is strong enough to suggest caution during severe epidemics. It might be well to consider that the real risk of doing the surgery should not be substituted for the fancied risk of poliomyelitis. However controversial, it would seem that postponement of an "elective" procedure is in the public interest and to the advantage of the physician.

The Impostor — Arthritis of the Spine. William H. Blodgett.

J. Michigan M. Soc. 50:1008 (Sept.) 1951.

Under the diagnostic aliases of lumbago, neuritis, sacroiliac strain, kidney, ureter and bladder disease, ptosis of various organs displaced vertebrae, lumbosacral instability and even herniated nucleus pulposis, the patient with atrophic arthritis of the spine moves from one physician's office to another in search of advice and treatment. The early symptoms and signs of rheumatoid arthritis of the spine simulate many other conditions and since there are remissions and exacerbations in the course of the disease the patient and the physician may accept an incorrect diagnosis and believe that treatment has been effective, only to be disappointed when a recurrence of symptoms occurs. The physical examination of the patient with early atrophic arthritis of the spine may be very unrevealing. However, there are certain identifying characteristics of the impostor—impostor because the disease for years may wear the mask of other entities. In the absence of any positive clues to diagnosis, repeated examination of the patient may be the deciding factor. A final indication of the presence of early atrophic arthritis of the spine may be that the patient fails to respond to the treatment as outlined for one of the many conditions which are worn as a mask by this slowly progressive lesion of the spine. Failure to respond to treatment should suggest the need for a change in diagnostic impression rather than a change of vitamin, physical therapy or the need for a new endocrine.

Poliomyelitis. Edward J. West, and Peter L. Mathieu, Jr.

Rhode Island M. J. 34:469 (Sept.) 1951.

Some factors of the epidemics of poliomyelitis occurring in Rhode Island are discussed in this article. The Charles V. Chapin Hospital in Providence cares for practically all of the hospitalized cases of poliomyelitis not only in Rhode Island but also in the nearby communities of Massachusetts and Connecticut, so the statistics presented are representative of those derived from an area of approximately three-quarters of a million population. It has been noted for some time that fatigue and excessive muscular activity have a definite predisposing factor toward poliomyelitis. It has been possible to obtain a very definite history of fatigue and exhaustion in most cases of poliomyelitis in adults admitted to the Chapin Hospital. Some have advocated three weeks of rest after any suspicion of poliomyelitis. Treatment at the Chapin Hospital resolves itself to diligent nursing and medical care during the first few days of the illness plus hot packs and physical therapy. Physical therapy consists of active and passive motion and exercise as soon as the patient can tolerate it after the temperature has returned to normal. The hot packs are of much value. In the warm summer months, when hot packs should be the most uncomfortable, the adult patients request them because of the comfort and satisfaction that they derive from them. Their usefulness is not all psychological, because they do relieve painful muscle spasm. The article also discusses possible relationships of tonsillectomy and immunizations to poliomyelitis, and gives a brief review of the last epidemic.

Venous Obstruction in the Upper Extremity. Milburn H. Querna.

Northwest Med. 50:671 (Sept.) 1951.

Venous obstruction occurs infrequently in the upper, as compared with the lower, extremity. It may be of more frequent occurrence than one is led to believe from reports in the literature. The disease is almost never fatal, its course is protracted and often not influenced by treatment, so perhaps this may discourage discussion. It may occur at any age, is most frequent during the active years, most often in active males and most frequently in the right arm. The onset is heralded by swelling and pain in most cases and may be abrupt or gradual. Often these occur first in the shoulder, then spread down the arm and upward over the pectoral region. Discoloration, most often a cyanotic hue, occasionally pink or red, is noted early. Venous distension is an early prominent finding in all cases. Paresthesias are noted in some patients. The diagnosis rarely presents difficulty. Trauma is considered the most usual inciting factor. The effort may have been lifting a heavy weight, working with the arm overhead, forcible abduction or external rotation of the arm, or a blow on the shoulder or upper chest. Treatment for the most part has been conservative — bed rest, elevation of the arm and heat.

Epidemic Poliomyelitis: Review of Five Hundred Twenty-Six Cases. Maurice Lenarsky; Robert L. Parr, and H. Eugene Seanor.

Am. J. Dis. Child. 82:160 (Aug.) 1951.

The significant clinical and pathological findings in 526 cases of poliomyelitis are presented and discussed. With the exception of a few patients, notably adults, muscle pain was not a predominating feature in this series. It may be that the early institution of moist heat served to minimize this complaint. Relief of muscle tightness and pain was accomplished satisfactorily by the application of hot packs — the "lay-on" type applied to the patient in the prone position and occasionally the Kenny "wrap-around" packs. Warm baths were used early for small children. An attempt was made to evaluate clinically certain drugs that have been advocated for the relief of muscle spasm and pain. Priscoline (2-benzyl-2-imidazoline hydrochloride), a sympathicolytic drug, was administered orally to 68 patients in the dosage used and recommended by Smith. The authors felt that most of the patients were not benefited by its use. It did have a relaxing and analgesic effect in some patients, but this was not consistent or sustained, and when administration of the drug was stopped, tightness recurred. In other patients it was thought that the muscle tightness was increased by the drug, and the return to hot packing gave quick relief. There were uncomfortable side effects such as nausea and vomiting, and since the drug must be continued for long periods, its potentiality for more serious reaction was always present. In general, the physical therapy staff preferred the hot packs, and there was enough personnel to carry out such procedures. The importance of early bed rest and the avoidance of fatigue as therapeutic and preventive measures in poliomyelitis have been stressed. Ressel has shown that there is a close correlation between the extent of muscle weakness and continued physical activity after the onset of the symptoms. Hargreaves and Horstmann have confirmed this. Transporation of the acutely ill poliomyelitis patient over long distances may contribute to fatigue and may in itself be hazardous. This is especially true of the bulbar poliomyelitis patient, for whom there is the danger of emergency situations that cannot be adequately handled en route because of lack of equipment and trained personnel.

Spasm of the Rectus Muscle. N. B. Jaffe.

Mil. Surgeon 109:204 (Sept.) 1951.

Spasm of the rectus muscle characterized by sudden painful contraction, tenderness, and lump formation lasting a few minutes, is a very common occurrence. It is more common after 30 years of age, but noted also in the young. Many young war veterans had this condition, which began during the difficulties of open warfare. It may be bilateral, but mostly unilateral on the left. The etiology and pathology are obscure and leave open fields for fancy and speculation. It is not crippling or in any way disabling, but very unpleasant, annoying, leading to nervousness, apprehension and loss of appetite. As it may occur when getting out of bed, it starts off the day with an unpleasant sensation, creating the popular feeling, "waking up on the wrong side," especially among the nervous. The same effect results when it occurs after an enjoyable repast. Many times it was related by the patients that they nearly had an automobile accident while driving when the cramplike episode developed and they were compelled to stop the car. The treatment consists of rest, hot baths, or hot applications, diathermia, electrical treatment, counterirritation, massage, vibration, local injection of procaine or novocain, antispasmodics, sedatives, and x-ray therapy. The immediate treatment which is very effective is to stand up and pull or bend backwards forcibly.

Chronic Empyema. T. Holmes Sellors, and Gordon Cruickshank.

Brit. J. Surg. 38:411 (April) 1951.

The principles of treatment of chronic empyema are three: (1) Elimination of toxic contents; (2) closure of the cavity and (3) restoration of lung function.

Prophylaxis by correct handling of the acute phase is the obvious basis for treatment and this can be best expressed by continued and adequate drainage coupled with intensive physical therapy. A motley variety of drainage and irrigation methods has been advocated from time to time, but these cannot replace the more simple and effective principles just laid down. A chronic empyema once diagnosed must be correctly drained and this drainage constantly supervised until complete healing has occurred, and with this surgical treatment vigorous physical therapy perseveringly pursued. On occasions it is justifiable to consider complete excision of the empyema with its walls and contents, and so remove a harmful dead space, leaving the lung free from constricting scar tissue, but this is a major operation and requires all the services of a fully equipped thoracic surgical unit. Respiratory physical therapy deserves special mention since it is only carried out with full effect in chest units. The requisite exercises aim at localized and forceful inspiratory efforts with the patient concentrating on moving the area of the empyema. Persistence and encouragement will result in the expansion of an immobile section of chest wall. The lung will follow this movement and help to obliterate the empyema cavity. These objects are easily achieved, but daily, even hourly, practice is essential. Ten to twenty minutes' exercises every waking hour produce results that cannot be obtained in any other way. In an extensive, rigid, chronic empyema a period of months may be required, and in one case success was reached only after a year and a half. The traditional measures of blowing up balloons and the like can be discarded, as they are expiratory in character and not inspiratory. Full postural and general exercises also should be used and the problem is simplified if the patient can be ambulatory for the greater part of the day and can take active physical exercise. For this reason the ordinary conditions pertaining to a general hospital are not ideal for the treatment of chronic empyemata.

Studies in Disorders of Muscle — IV: The Clinical Manifestations and Inheritance of Childhood Progressive Muscular Dystrophy. Frank H. Tyler, and F. S. Stephens.

Ann. Int. Med. 35:169 (July) 1951.

This is a study of 33 kindreds. In these families, 61 patients with childhood progressive muscular dystrophy were found. All living members of these kindreds thought to have neuromuscular disorders have been examined, as have the parents of our patients, their siblings and certain other genetically related individuals, even though these relatives were reported to be normal. The clinical course of the majority of these patients was consistent. Typically, after the onset in early childhood, these patients walked with slowly increasing difficulty until nine or twelve years of age, when they became confined to a wheelchair because of inability to walk without support. In addition to the muscular weakness, they developed contractures in the Achilles, hamstring and biceps tendons which contributed to their disability. The contractures were in some degree postponed by persistent activity and/or physical therapy. Without the most persistent care, the boys became progressively deformed once they were unable to walk, until grotesque deformities were present in the position which the child elected or had to use because of his weakness. The large pelvic girdle muscles were the first involved in a process which spreads centrifugally in an insidious fashion to produce extreme muscular disability. Most of the patients are severely disabled in adolescence and die then or in early adult life. None of these patients has had children.

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ORIGINAL ARTICLES

Energy Costs of Various Physical Activities in Relation to Pulmonary Tuberculosis. Edward E. Gordon, M.D. 201
Discussed by Dr. B. B. Bagby, Jr.

Effect of Contrast Baths on the Vasomotor Response of Rheumatoid Arthritis Patients. Fred J. Fricke, M.D., and Jerome W. Gersten, M.D. 210
Discussed by Drs. J. G. Jenkins; H. Samberg, and F. J. Fricke.

Electromyographic Recording of Muscular Activity in Normal and Spastic Gaits. Gerald G. Hirschberg, M.D., and Morton Nathanson, M.D. 217
Discussed by Drs. E. J. Krusen, Jr.; G. G. Hirschberg; H. Samberg; W. Darley, and W. B. Snow.

Federal Control of Medical Devices. Irvin Kerlan, M.D. 225
Discussed by Mr. H. A. Carter, and Dr. I. Kerlan.

Weak Thumb Opposition Due to Poliomyelitis. Ralph E. Worden, M.D., and Miland E. Knapp, M.D. 230
Discussed by Drs. H. L. Rudolph, and M. E. Knapp.

●

Medical News 235

●

Editorials 239

●

Book Reviews 241

●

Physical Medicine Abstracts 244

●

EDITOR OF THE MONTH

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1952

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ENERGY COSTS OF VARIOUS PHYSICAL ACTIVITIES IN RELATION TO PULMONARY TUBERCULOSIS *

EDWARD E. GORDON, M.D.†

NEW YORK

In the course of management of pulmonary tuberculosis, the question often arises as to how much physical activity a given patient may assume and yet safely avoid stress with possible reactivation of his disease. Precise definition of the limit between tolerance and stress is not possible, for neither are the relevant factors fully understood nor are measurements feasible. However, the intensity of physiological work, i. e., the energy expended in the performance of a task, can be readily obtained. While this method does not reveal the working capacity of an individual, it has the following advantages: (1) the degree of cardiovascular response roughly parallels the intensity of work in terms of energy expenditure; (2) respiratory responses are easily obtained along with the measurement of work intensity. Thus, a rough index of the magnitude of cardio-respiratory stress imposed upon a patient is afforded by a determination of the work intensity of a given task. The intensity of energy expenditure is readily measured in terms of oxygen consumption per minute. On this basis energy costs of some common activities were determined to provide the clinician with a knowledge of their general orders of magnitude. This knowledge could serve as a guide in passing judgment on the wisdom of allowing a patient to engage in a particular activity when apparently indicated on clinical grounds.

Method

As a preliminary investigation to ascertain whether different individuals would display equivalent results in the performance of a given task, mainly healthy subjects were tested. Nine normal female and four normal male subjects were used; as the investigation progressed, four male patients on ambulatory status were included in the study. These exhibited no impairment of pulmonary function and presented the usual bacteriologic and radiologic criteria of apparently arrested disease for four to six months. Such subjects probably afforded values for working energy cost comparable to those for healthy subjects, since they were on an ambulatory status and, consequently, in a better state of physical fitness than clinically active patients. No attempt was made to compare results derived from healthy subjects with those from patients, as the latter comprised too small a group.

Fifty-three experiments were carried out with the normal group and five with patients. Tasks selected were those applicable to patients either on a modified bed-rest program or on limited ambulation. Since the rate of work influences the energy expenditure, it was controlled whenever possible; otherwise the optimum tempo for the individual was allowed. Table 1 lists all experiments on healthy subjects, the modalities tested, materials used, the speed of performance and the working positions assumed. In addition to those experiments listed in Table 1, one patient was used for leather punch-

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* "Sponsored by Vetera [illegible] ed with approval of Chief Medical Director. The statements and conclusions [illegible] a result of his own study and do not necessarily reflect opinion or policy of [illegible]" From Halloran V. A. Hospital, Staten Island New York.

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TABLE 1. Modalities and Materials Used and Speed of Performance.

Modality	No. of Experiments	Material Used	Speed of Performance	Position of Work
Link Belt	4	Thin grained leather	4 links per 3 min.	In bed
Link Belt	4	Cowhide leather	4 links per 3 min.	In bed
Leather Punching and Lacing	4	Tooling calf leather, 2 or 3 thicknesses, No. 1 Punch	30 holes per 15 min.	In bed
Leather Tooling	4	Tooling calf leather	Optimum speed	In bed
Chip Carving	6	Bass wood, Dexter knife	Optimum speed	In bed
Copper Tooling	5	Copper foil, 36 gauge	Optimum speed	Sitting
Chisel Carving	6	Pine wood	Optimum speed	Sitting
Chisel Carving	6	Gum wood	Optimum speed	Sitting
Hand Loom [1]	4	Pearl cotton #3, warp and weft	Two operations per min.	Sitting
Floor loom [2]	4	Carpet warp Chenille weft	Two operations per min.	Sitting

1. 4-harness structo table loom, 20" reed.
2. 6-treadle, 4-harness Hammett floor loom, 45" reed.

ing and lacing; another for leather tooling. A third patient was also tested while working at a sanding lathe, and one experiment on letter writing was carried out on a normal person while seated at a desk. In addition, it was thought of interest to determine the metabolic costs of showering and the use of a self-propelled wheel chair from bed to lavatory. Four determinations were made in the former instance and three in the latter. The subjects were healthy individuals, except for one patient, who was used in both activities. The temperature of the water for the shower, adjusted to each subject's liking, was judged to be tepid. The rate of wheeling was fixed at 34 ft./sec., or 1.2 m.p.h., on level ground.

The energy requirements were deduced in the usual manner from determination of oxygen consumption. Because of variations in size, age and sex of individuals, energy cost of a particular task was expressed in terms of per cent increase over the basal metabolic expenditure. Therefore, for each experiment two determinations were made, viz., the basal metabolic rate (BMR) and the working metabolic rate. BMR was obtained in the customary manner: with the subject fasting and in the recumbent position for a preliminary period of 30 minutes. By means of a suitable valve arrangement room air was inhaled and the expired air was trapped in a large Douglas bag during an accurately timed period which lasted until a suitable volume of gas was obtained: 70-100 L. The respiratory rate was counted during the collection period for a full minute at three-minute intervals. A ten-minute period of inactivity was then allowed; if a proposed task was to be done in bed, the subject lay propped up on pillows, otherwise he sat quietly in a chair. The one subject tested at the sanding lathe stood at rest for the required time. The signal was then given to start a predetermined task. After two minutes of activity had elapsed, another timed collection of expired air was carried out, lasting from five to twelve minutes according to the degree of ventilation. Respiratory rate was again counted every two or three minutes. Both volumes of expired air were subsequently measured in a Tissot spirometer, corrected to standard pressure and temperature, and pulmonary minute volumes (PMV) for rest and work derived. Concentrations of CO_2 and O_2 of the expired gases were found with the Haldane gas analyzer.* From these values and the respective PMV, basal and working oxygen consumptions per minute were calculated. Since the rate of oxygen consumption is proportional to the energy production, the energy costs could be deduced from the O_2 consumptions, provided no oxygen debt was incurred during the activity. The intensity of work achieved in all of these experiments was of a low enough order to obviate this feature. The rate of energy cost of a given task was calculated as the per cent increase above basal rate:

$$\%\text{ rise of energy cost} = \frac{\text{working } O_2 \text{ cons./min.} - \text{resting } O_2 \text{ cons./min.}}{\text{resting } O_2 \text{ cons./min.}} \times 100$$

Since respiratory rate and PMV were obtained in the course of each experiment, average tidal volume (volume of each respiration) under basal and working conditions could be calculated.

Results

Energy Cost. — Fig. 1 illustrates the per cent increase in energy cost encountered in normal subjects for four activities tested in a reclining position; for all practical purposes the five average values indicated (22, 24, 27, 39, 45)

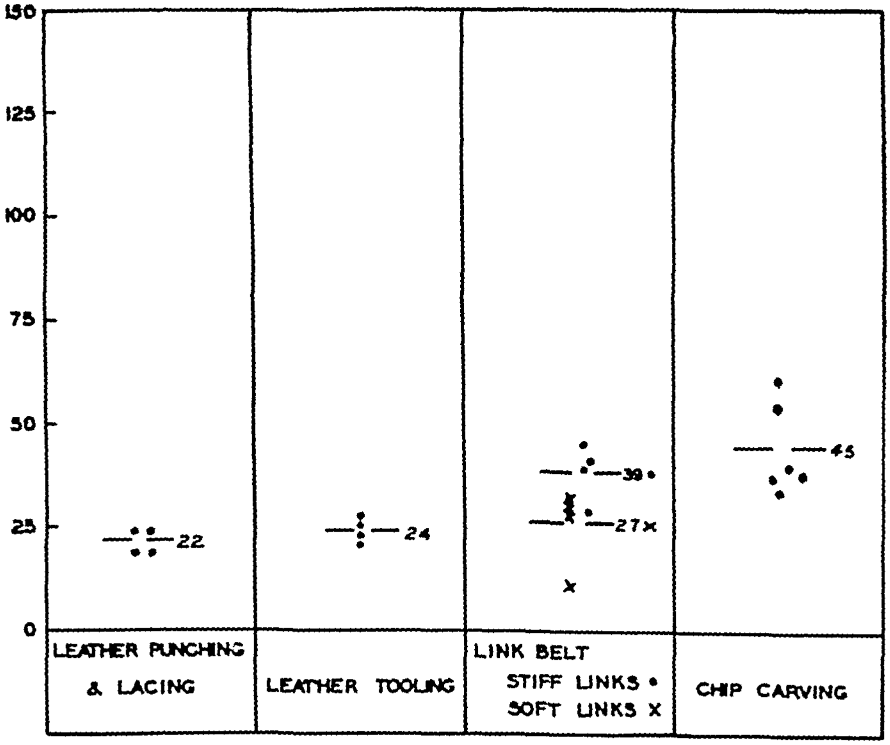

Fig. 1. — Energy cost of activities performed reclining. Ordinates represent per cent increase of working energy cost above basal. Each point represents a different subject. Bars denote mean.

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* In later experiments the Scholander apparatus was used.

should be regarded as falling into the same order of magnitude. Of two patients tested, one showed a 22 per cent rise for leather punching and lacing (average for normal subjects —22 per per cent); while another, a 39 per cent rise for leather tooling (average for normal subjects — 24 per cent). The difference between the latter two values may be regarded as of small significance in metabolic terms. The individual variations observed in a given task may, apparently, be attributed to differences in training and neuromuscular tension during work.

Fig. 2 gives the values found in normal subjects for four activities performed in a sitting position. There is a fair degree of agreement between different subjects, except for two observations on chisel carving (173 and 164 per cent) on one individual who was rather tense. It may be pointed out that, since the energy cost of sitting at rest exceeds that of the basal state by 17 to 25,[1-2] copper tooling, hand-loom weaving and chisel carving would require even lower costs, were they done in the reclining position.

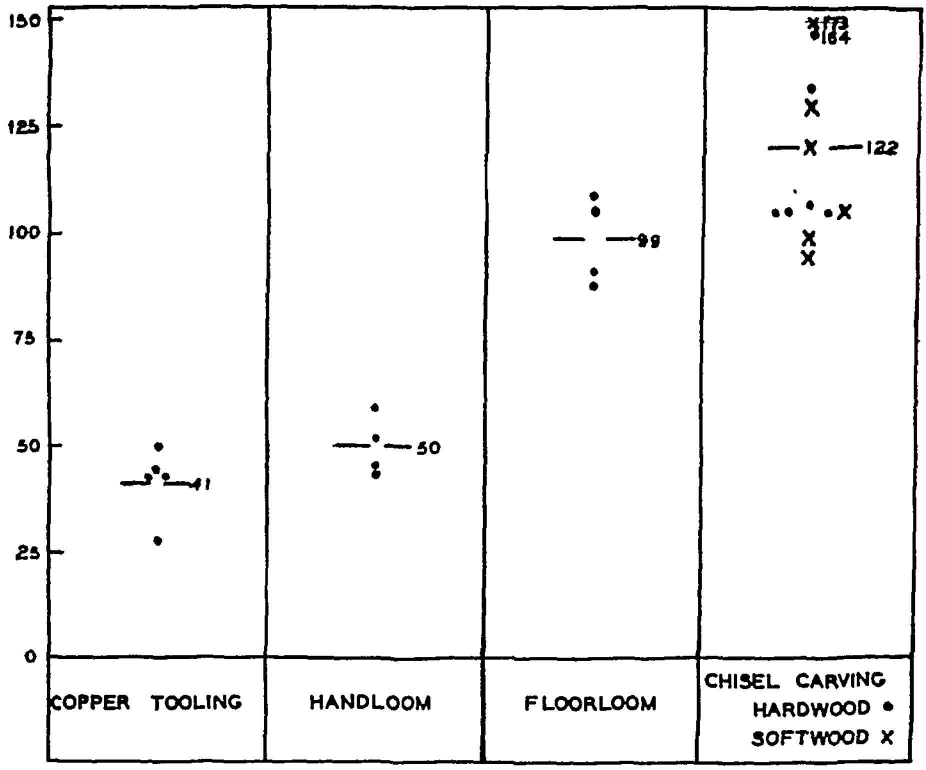

Fig. 2. — Energy cost of activities performed sitting. Ordinates represent per cent increase of working energy cost above basal. Each point represents a different subject. Bars denote mean.

Letter writing, tested in one normal subject, yielded a value of 20 per cent rise above basal. This agrees with a rise of 13 and 26 per cent mentioned by Orr and Leitch; the value of 75 per cent given by data published by the Harvard Fatigue Lab. appears excessive.[1] The one experiment on the sanding lathe presented an increase in energy expenditure of 119 per cent above basal.

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1. Laboratory Manual of Field Methods for Biochemical Assessment of Metabolic and Nutritional Conditions. Harvard Fatigue Laboratory, March, 1946.
2. Orr, J. B., and Leitch, I.: Nutrition Abstracts and Reviews, 1937-38, 7:509.

The results of experiments on energy cost for showering were of some surprise, since the range of metabolic work was found to be rather high (see Table 2). The lowest value was displayed by the one patient included in this group; he was more deliberate in his actions. In spite of these apparently marked variations (from 242 to 377 per cent), the values may be considered to show a good correspondence, when the difference in habit patterns between individuals is taken into account. The level of physiological work involved in self-locomotion in a wheel chair was also found to be higher than that which would ordinarily be surmised (see Table 2).

TABLE 2. — *Per Cent Increase of Energy Cost of Activities Over Basal.*

Subject	Showering	Self-Propulsion in Wheel Chair
1*	242	138
2**	301	137
3**	377	134
4**	350	......

* Patient.
** Normal Subjects.

Pulmonary Minute Volume. — Activities up to 170 per cent rise in working O_2 consumption were plotted against the corresponding per cent rise in PMV and an average line drawn through the points. This relationship is presented in Fig. 3. In general, it is obvious that there is a rough proportionality between energy expenditure and ventilation, the upper portions of the curve tending to flatten slightly, so that the ratio of ordinate to abscissa in this range was found to be about 0.67. Values with high energy costs, such as those derived from the four experiments on showering, conformed, approximately, to this relationship, viz., the ratios of per cent rise of PMV to per cent rise of O_2 consumption being 0.67, 0.70, 0.83, 0.59. Therefore, it would appear that the water itself produced no reflex stimulation of respiration, probably because the temperature was mild, and that the activity associated

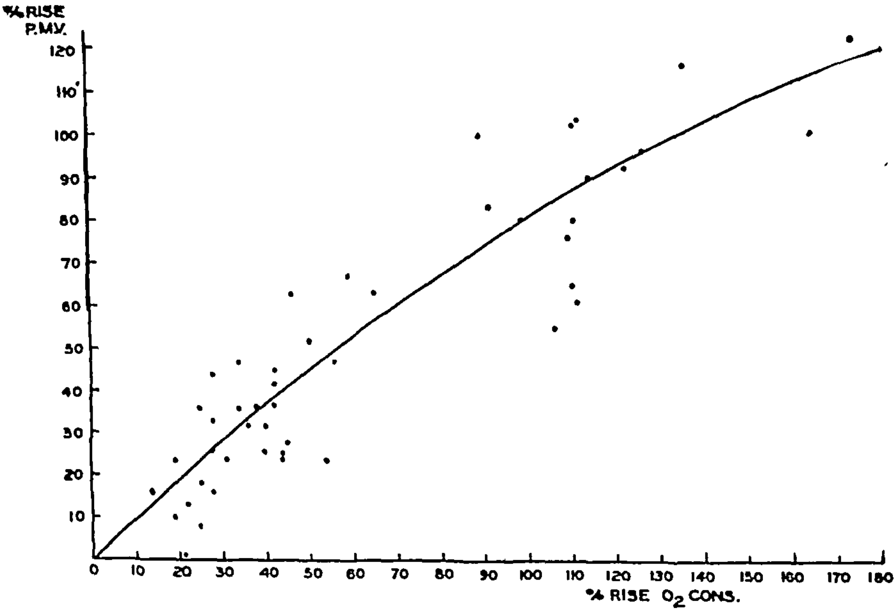

Fig. 3. — Relationship between increments in working energy cost and pulmonary minute volume. For lower increments of energy cost the slope of the curve is about 1; for higher increments, about 0.67.

with showering was solely responsible for the observed physiological effects.

Tidal Volume. — In the field of pulmonary tuberculosis it is likely that PMV may not be the best index of respiratory stress in terms of local organ disease. Even if the energy cost of an activity is relatively low the rise in PMV, though small, may be almost entirely due to increase in depth of respiration; a critical point may be exceeded at which stretching aggravates a lesion such as a cavity or an endobronchial ulceration. Hence the effect of work on ventilation was extended to include studies on depth of respiration, with tidal volumes used as an index.

In Fig. 4 the per cent increase in 0_2 consumption has been plotted against the corresponding per cent increase in tidal volume. It will be noted that three-quarters of the experiments yielding an energy cost of 65 per cent or less showed only a small increment (up to 20 per cent), no change, or a decrease in tidal volume; practically all activities with costs higher than 65 per cent displayed larger rises in tidal volume (over 20 per cent). Thus, in the former instance, the rise in PMV is attributable mainly to increase in respiratory rate. The significance of this finding will be further discussed.

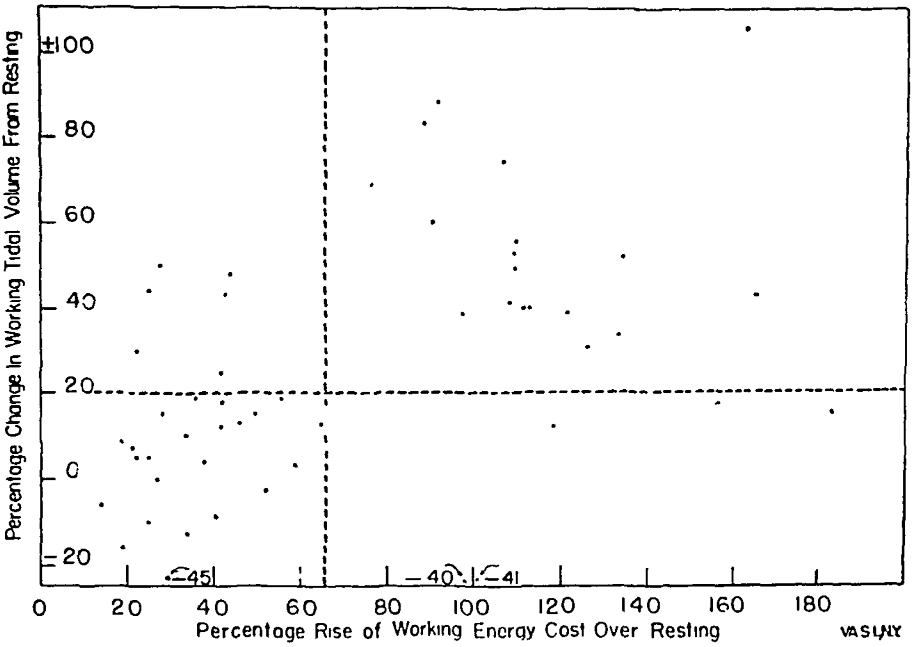

Fig. 4. — Relationship between increments in working energy cost and tidal volume. The dotted line projected from 65 per cent on the abscissa includes most of the points indicating a fall, no change, or a small rise in tidal volume, i. e., 20 per cent in working tidal volume. Large increases in tidal volume are associated with large increases in energy cost.

Discussion

It is emphasized that this work is concerned only with the intensity of the rates of energy cost of various activities and not with the total sum of daily energy expenditure. It is believed that the factor of intensity is fully as important as the total sum, since a short burst of relatively high energy cost may be injurious to the tuberculous patient by exceeding a certain critical level above which physiological stress may cause pathologic changes. For example, a physician rightly hesitates to allow showering for some patients still in a dubious clinical status; the four or five minutes required to perform the activity contributes an insignificant amount to the total daily expenditure, yet the relatively high intensity of physiological stress engendered even for a short time casts doubt on the wisdom of allowing it. In this light, a knowledge of the intensity levels of energy costs may help contribute to the final judgment regarding the prescription of certain activities for a patient. Therefore, a compilation of energy costs is presented, in which have been utilized both observations from these experiments and those reported in the literature.* In Table 3 are grouped values for activities of daily living and for work therapy.†

TABLE 3. — *Energy Cost of Self-Care and Work Activities.*

Activities	% Rise	Source
Sitting	17–25	Harvard Fatigue Lab. (1), Orr (2)
Standing relaxed	38	Harvard Fatigue Lab.
Conversation	38	Harvard Fatigue Lab.
Dressing and undressing	43–53	Sherman (3) Brody, et al. (2)
Personal toilet	38	Harvard Fatigue Lab.
Showering	242–377	Author
Eating a meal	38	Harvard Fatigue Lab.
Writing a letter	75	Harvard Fatigue Lab.
	20	Author, Kestner, et al. (2)
Strolling	75	Harvard Fatigue Lab.
Walking slowly (2.6 m.p.h.)	160	Sherman
Using wheel chair (1.2 m.p.h.)	138	Author
Walking moderately fast (3.75 m.p.h.)	290	Sherman
Walking downstairs	320	Sherman
Walking upstairs	1330	Sherman
Hand sewing	40	Sherman
Knitting (23 stitches/min., sweater)	50	Sherman
Making link belt (reclining):		
stiff leather (4 links/3 min.)	39	Author
soft leather (4 links/3 min.)	27	Author
Leather tooling (reclining)	24	Author
Leather punching and lacing (reclining)	22	Author
Chip carving (reclining)	45	Author
Copper tooling (sitting)	41	Author
Weaving — hand loom (2 operations/min.)	50	Author
Weaving — floor loom (2 operations/min.)	99	Author
Chisel carving (sitting)	122	Author
Tailoring	75–105	Sherman, Farkas, et al. (2)
Typing	20–50	Kestner, et al. (2)
Typing rapidly	82	Sherman
Bookbinding, light	56–92	Kestner, et al. (2)
Bookbinding, partly heavy	105–120	Sherman, Kestner, et al.
Wood work on sanding lathe	119	Author

The levels of energy cost assigned to the various activities studied may err on the low side. In the first place, a majority of the subjects were normal, healthy individuals, all of whom were trained in the tasks performed. This combination of factors might have operated to give results lower than those possibly attained by patients newly assigned to some sort of physical activity. However, since work is contraindicated for acutely ill patients, and since the tasks utilized can be quickly learned, it is probable that the patients ready for some activity would closely approximate the values obtained in this study.

A second possible source of error may stem from the oxygen debt incurred during activities of relatively high energy cost. Occurrence of an oxy-

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* Values from the literature have been recalculated in terms of per cent rise of energy cost above basal. To calculate back to total working energy cost per hour, assuming a "mean man" of 1.77 sq. m. with a BMR of 77 cal./hr.:

$$\text{Working cal./hr.} = \text{BMR}\left(\frac{\%\ \text{rise}}{100} - 1\right)$$

† Harvard Fatigue Lab. data are partly original and partly compiled from other sources.

3. Sherman, H. C.: Chemistry of Food and Nutrition, New York, Macmillan Co., 1956, 7 ed., p. 189.

gen debt would be expected to yield falsely low values, inasmuch as post-activity recovery periods were not studied. However, none of the activities performed is of great enough intensity to produce a significant oxygen debt.

It may be noted from Table 3 that showering is a high energy cost activity comparable, at least, to walking 3.75 m.p.r. or walking downstairs. The conclusion as applied to bed-rest patients is obvious. Again, a patient who believes that he obviates the stress of walking by propelling himself in a wheel chair can be quickly disenchanted by being shown that, for all practical purposes, he is walking at about 2 m.p.h. It is pointed out, in passing, that climbing stairs is an extremely arduous activity. On the other hand, many of the occupational interests impose minimal demands, especially if they can be undertaken with the patient comfortably propped up in bed. The small physiological activity that they would entail may be more than balanced by the release of mental tension and, consequently, achievement of more nearly complete rest during the remainder of the day.

The presentation of tables of energy cost should not be interpreted to mean the advocacy of prescription for activity in precise dosages. This procedure is neither attainable nor desirable. Rather, it is hoped that on the basis of a rough approximation of the physiological stress sustained in doing a given activity, the patient and physician will be on surer ground. From a practical point of view, choice of activities may be contained within physiologically meaningful limits.

These limits with respect to pulmonary tuberculosis have already been suggested from the analysis of the effects on tidal volume. It is apparent from Fig. 4 that those tasks showing low levels of energy cost (up to 65 per cent) have little or no effect upon tidal volume. From the point of view of local organ pathology, therefore, it appears that patients on bed rest probably would be subjected to little additional respiratory stress while engaged in activities within the limits of 65 per cent when clinically indicated. On the other hand, tasks associated with higher levels of energy cost produce a larger increase in tidal volume and may be reserved for patients on an ambulatory status. Thus, the boundary between minimal and moderate stress is suggested on physiological grounds rather than arbitrarily. However, further work along these lines is indicated, both in substantiating these findings and investigating the influence of bodily position upon tidal volume during activity. A more complete assessment of local organ stress during work would demand also a knowledge of changes in hemodynamics of the pulmonary vascular bed.

It is emphasized that selection of activities on the basis just described is applicable only to individuals with little or no impairment of pulmonary function (and cardiac reserve). In those with lowered function due to fibrosis or surgical procedures, moderate increases of pulmonary ventilation may spell frank dyspnea. Tidal volume will also rise beyond the level predicted for subjects with normal pulmonary function, because of lowered ventilatory reserve. These implications of lowered respiratory function deserve further study to establish that level of energy cost which is compatible with pulmonary (and cardiac) functional capacity.

Summary and Conclusions

1. Preliminary experiments have been made mainly on healthy subjects to determine the energy costs for several occupational and daily living activities in terms of oxygen consumption. A table of rates of energy cost has been compiled from this work and the literature to serve as an index of the

order of magnitude of the physiological stress entailed in various activities.

2. It has been found that activities of low energy cost (up to 65 per cent) were usually associated with disproportionately small changes in tidal volume. This finding may be of practical significance in the management of patients on bed rest, since it suggests that the danger of mechanical stress upon the lung may be minimal within this range of work intensity.

Discussion

Dr. B. B. Bagby, Jr. (Oteen, N. C.): I first would like to compliment Dr. Gordon for presenting such an interesting and timely subject and one which is so vitally needed for those of us dealing with the rehabilitation of the tuberculous. I feel that his work is very basic in its concept and that he has made a very creditable step toward giving us something tangible in the direction of the energy requirements in various activities. The one great difficulty in such a program and in such figures is, unfortunately, the difficulty of evaluating the energy cost of an individual. As Dr. Gordon has pointed out, the necessary individual energy costs of different persons vary so much in that the more skilled an individual is in a given activity the less the energy cost.

In applying this to tuberculosis patients, this problem becomes even more pronounced since it is definitely shown by a number of people that the mental attitude of the patient determines greatly his approach to activity.

I think it is also important that Dr. Gordon's study of stress is to be considered much further because it has been our experience in the Rehabilitation Center, V. A. Hospital, Oteen, North Carolina, based on some 1800 discharges in the last 4½ years, that the patient who has a routine program — one in which his mode of living and his vocational endeavor have no marked peak but more or less run on a level or rolling type of activity, does much better than the patient whose life and vocation calls for spurts and peak demands for activity. We have also found that the patient who has a definite routine — that is, goes to school or steady work rather than working only spasmodically, has a noticeably better record insofar as the reactivation of their disease is concerned. I am sure that all will profit by Dr. Gordon's tests. His work should be expanded and further studies made for the benefit of all.

EFFECT OF CONTRAST BATHS ON THE VASOMOTOR RESPONSE OF RHEUMATOID ARTHRITIS PATIENTS [*]

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Although changes in the peripheral circulation of patients with rheumatoid arthritis have been noted frequently, these changes have not been sufficiently constant so that a specific vasomotor picture could be associated with this disease. Most commonly noted has been a decrease in the cutaneous temperature of the fingers.[1-4] Ghormley and Silverglade,[5] however, found considerable variation in the skin temperatures of both normal individuals and patients with rheumatoid arthritis.

As far as vasomotor response was concerned, Martin[6] and his co-workers found that there was no constant defect in the peripheral circulatory adaptability in rheumatoid arthritis, though the response to warmth after a period of cooling was slow and irregular.

Wright and Pemberton[1] found that on exposure to cold the cutaneous temperature decreased more in the normal individual than in the patient with rheumatoid arthritis. Woodmansey[3] noted that after exposure of an extremity to water at a temperature of 15 degrees C. for one minute, the return of cutaneous temperature to control values was often slower in the rheumatoid arthritic than in the normal.

Similar observations were made by Naide,[7,8] who concluded that these patients showed a high degree of vascular tone. Steinbrocker and Samuels,[4] using such indices as oscillometric readings, temperature and color change of skin, found that approximately 50 per cent of the rheumatoid arthritis patients showed evidence of arteriolar vasospasm.

Contrast baths have long been used to provide symptomatic improvement in joint disease,[9] though there is no evidence that they produce permanent circulatory improvement.[10]

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[*] Read at the Twenty-Ninth Annual Session of the American Congress of Physical Medicine, Denver, Colorado, September 5, 1951.

[*] Abridgement of a thesis submitted by Dr. Fricke to the Faculty of the Graduate School, University of Colorado, *in partial fulfilment of the requirements for the degree of Master of Science in Physical Medicine* and Rehabilitation

[*] Published with permission of the Chief Medical Director, Department of Medicine and Surgery, Veterans Administration, who assumes no responsibility for the opinions expressed or conclusions drawn by the authors

[**] The paper was written while Dr Fricke was a resident at Fort Logan VA Hospital He is now Chief, Physical Medicine Rehabilitation Service, Veterans Administration Hospital, Omaha, Nebr.

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The purpose of this study was to determine the peripheral vascular response of the rheumatoid arthritic to cold, and to note what effect contrast baths might have on these reactions.

Methods

Cutaneous temperature of the dorsum of the third finger just proximal to the nail was taken by means of a thermistor. Room and cutaneous temperature were recorded every five minutes until the cutaneous temperature was fairly constant. The entire hand was then immersed in cold water at 15 C. for one minute. After removal of the hand from the cold water the cutaneous temperature was recorded every minute for five minutes, and then every two and one-half minutes until the control level had been reached or approximated.

The rate of return of cutaneous temperature to the control level was represented as 100 times the ratio of the rise in skin temperature after removal from the cold water to the fall in cutaneous temperature on immersion in cold water. For example, if the skin temperature fell from 33 C. to 23 C. on immersion in cold water, and rose to 30 C. five minutes after removal from the cold water this would be referred to as a 70 per cent return in five minutes.

Ten patients with rheumatoid arthritis were studied, in which, after the control reaction to the test stimulus was recorded, there was daily treatment with contrast baths for periods up to five weeks. The schedule followed was hot water (110 F.) for ten minutes, cold water (60 F.) for one minute, then alternating hot and cold for four minutes and one minute, respectively, until the total time of treatment was thirty minutes. At weekly intervals the reaction to the cold stimulus of 15 C. for one minute was tested. All of these patients had involvement of the hands. The average age of this group was 49 years, with a range from 27 to 69 years.

In ten "normal" subjects, without any clinical evidence of arthritis or peripheral vascular disease, the reaction to the cold stimulus (15 C. for one minute) was tested. The average age of this group was 35 years, with a range from 23 to 54 years.

Results

Normal Subjects: These experiments were performed at an average room temperature of 24.4 C., with a range from 23.4 to 25.3. This range applied to the entire group, and not to any one experiment, in which the fluctuation was usually within 1 C. The mean control cutaneous temperature was 33.3 C. Immediately after one minute of immersion of the hand in cold water at 15 C., there was an average decline in cutaneous temperature of 8.3 C. (±0.5 C.)* (figure 1). Five minutes after removal of the hand from the cold water, the cutaneous temperature had returned 71 per cent (±5.4 per cent) toward the control levels, while after ten minutes the return was 88 per cent (±3.4 per cent).

Rheumatoid Arthritis Subjects: Ten patients were treated with contrast baths. The mean room temperature at which these experiments were performed

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[9] Comroe, Bernard I.: Arthritis and Allied Conditions, Lea & Febiger, Philadelphia, 1944, p. 247.

[10] Hines, E. A., Jr., and Kvale, W. F.: Circulation: Effects of Heat and Cold, Exercise and Posture, in: Glasser, O.: Medical Physics, Chicago, The Yearbook Publishers, Inc., 1944, pp. 194-206.

* Standard error of the mean.

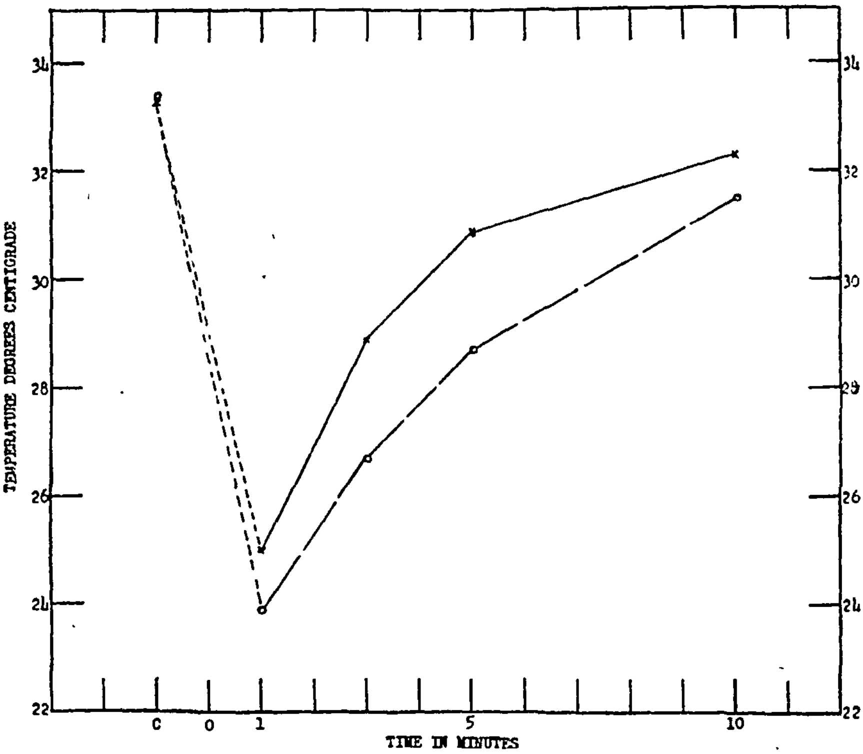

Fig. 1. — The effect on cutaneous temperature of immersion of the hand in water at 15 degrees C. for one minute. On the abscissa, C represents the average control cutaneous temperature and O the time of removal of the hand from the cold water. The solid line represents the temperature of the controls and the broken line the temperature of the rheumatoid arthritis patients.

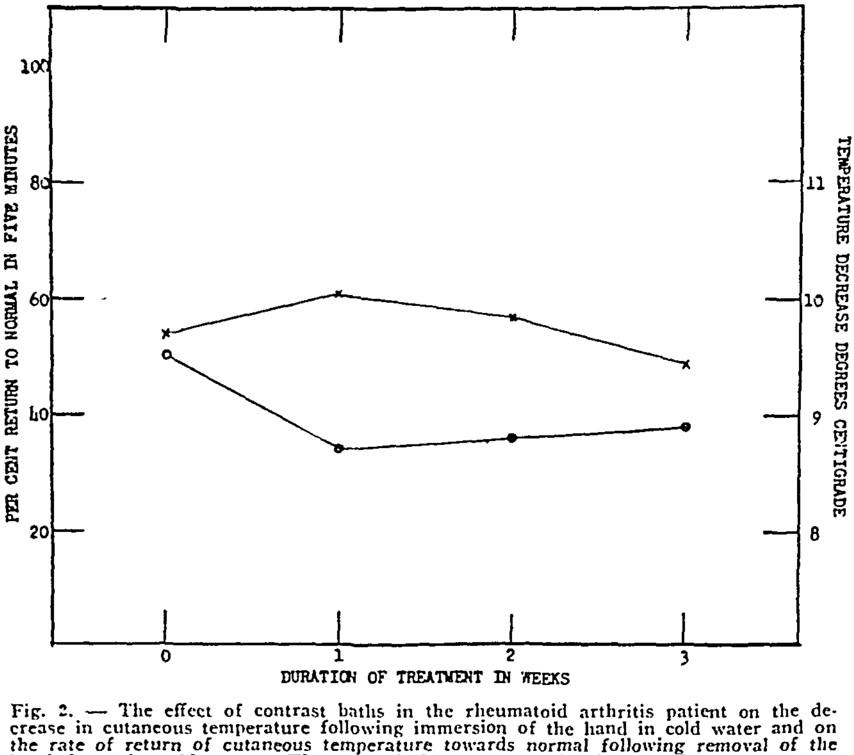

Fig. 2. — The effect of contrast baths in the rheumatoid arthritis patient on the decrease in cutaneous temperature following immersion of the hand in cold water and on the rate of return of cutaneous temperature towards normal following removal of the hand from the cold water. The open circles represent the decline of cutaneous temperature while the crosses represent the percentage return of cutaneous temperature to normal five minutes after removal of the hand from cold water.

was 24.7 C., with a range from 24.1 to 25.4 C. The average cutaneous temperature before immersion in cold water was 33.4 C., approximately the same as the control temperature in the normal subjects. Immediately after one minute of immersion of the hand in cold water, there was an average decrease in cutaneous temperature of 9.5 C. (±0.16 C.), (figure 1). This decline in temperature was significantly greater ('p' value 0.02) than the decline in cutaneous temperature of the normal subjects on exposure to cold. The rate of return of the cutaneous temperature to normal levels was significantly slower than in the normal subjects. Five minutes after removal of the extremity from the cold water, the cutaneous temperature had returned 51 per cent (±5.2 per cent) toward control levels while after ten minutes the return was 80 per cent (±3.7 per cent). The return at five minutes was significantly slower in the patient with rheumatoid arthritis than in the normal subject, with 'p' value for the difference of 0.01 (20 per cent).

After control levels for the magnitude of decline in cutaneous temperature on exposure to cold, and for the rate of return to normal on removal from cold had been established (at least four observations on each subject, with a total of 41 control observations) the patients were treated with contrast baths. The degree of decline in cutaneous temperature on immersion in cold water was significantly reduced by contrast baths (figure 2), though it was still somewhat greater at the end of three weeks of treatment than it was in the normal subject. The average decrease in skin temperature on cold exposure during the period of contrast bath therapy was 8.8 C. This decline was 0.7 C. (±0.22 C.) smaller than the decrease before contrast baths had been begun, significant at approximately the 0.5 per cent level of confidence. As seen in figure 2, the change in response to cold occurred within the first week of contrast bath therapy, and remained at approximately the same level during the remainder of the period of treatment.

The rate of return of the cutaneous temperature to normal was not significantly altered by the contrast baths (figure 2).[*] If anything, there seemed to be a slower rate of return to normal as the treatment was continued.

Preliminary observations made on 8 patients with rheumatoid arthritis suggested that the decrease in the fall in skin temperature on exposure to cold during the contrast bath therapy was specifically the result of the alternation of hot and cold. In 4 patients the reaction to the cold stimulus was studied before and after a period of daily treatment of the hands with water at 110 F. for twenty-six minutes, while the 4 other patients were studied before and after daily treatment of the hands at 60 F. for four minutes. The periods used were the same as the total time at each temperature in the contrast baths. In the group treated with warm water, the mean decline in cutaneous temperature before therapy was 9.3 C., while after one and two weeks of treatment it was 9.4 C. In the other group the mean control fall in skin temperature was 9.2 C., while after one and two weeks of cold water therapy it was 9.0 C. Neither change was a significant one.

Comment

Most previous workers have found a lower cutaneous temperature in rheumatoid arthritis patients than in normal individuals. This was not demonstrated by our experiments. The average initial cutaneous temperature of the rheumatoid arthritis patients was 33.4 C. as compared with a cutaneous temperature of 33.3 C. in the controls. These studies indicate that, on prolonged exposure to an ambient temperature of approximately 24.5 to 25.0 C., the patient with rheumatoid arthritis can have as great a cutaneous vasodilatation as the normal subject. With a cold stimulus, however, the decline in cutaneous temperature is definitely greater in the rheumatoid arthritis patient (9.5 C.) than in the normal control (8.3 C.). This is illustrated by the scatter diagram (figure 3). Ninety-six per cent of the arthritic patients had a decrease in cutaneous temperature greater than 8 C. in response to the cold stimulus, while only 60 per cent of the normal subjects had a fall in skin temperature greater than 8 C. in response to the same stimulus. This finding confirms the observations of most other workers.

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[*] The control level of 54 per cent is different from the control level of 51 per cent noted previously because 3 patients whose control levels were taken did not receive contrast baths. The 51 per cent figure refers to all patients tested, while the 54 per cent figure refers only to those who received treatment and were followed for 3 weeks.

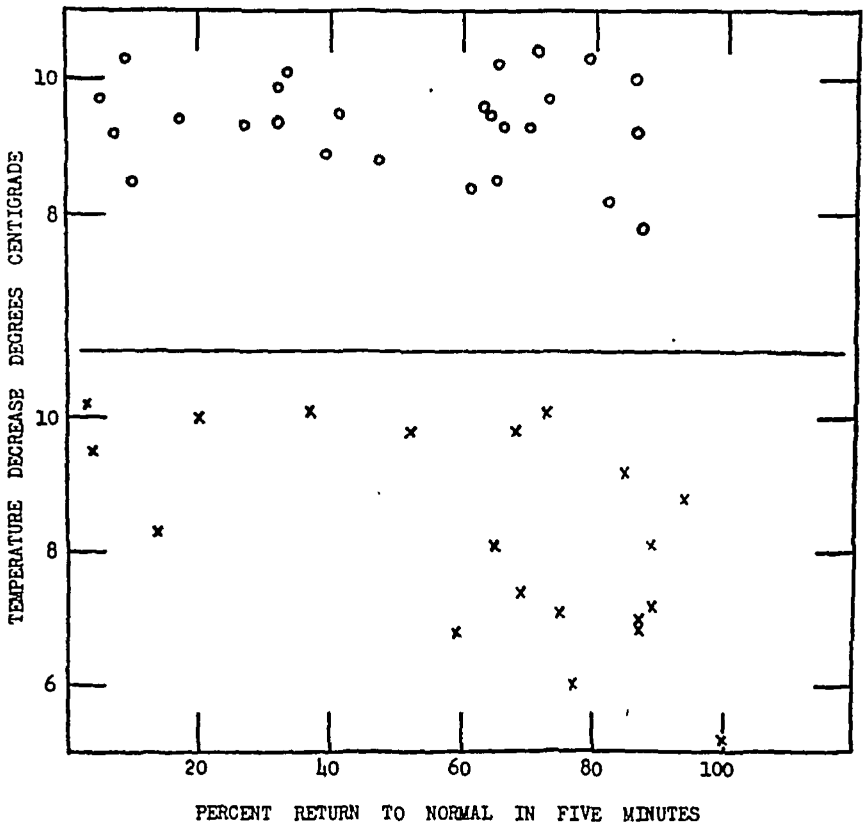

Fig. 3. — Scatter diagram relating the magnitude of fall in cutaneous temperature on immersion of the hand in cold water to the rate of return of cutaneous temperature towards normal following removal from the cold water. The crosses refer to the normal individuals, the open circles to the rheumatoid arthritis patients.

The local vasoconstriction following the application of cold is partly the result of a direct effect on the arteriolar musculature, and partly the result of reflex effects. These studies do not indicate which of these (or both, possibly) is primarily responsible for the unusual sensitivity of the patient with rheumatoid arthritis to the cold stimulus.

Not only is the vasoconstriction following cold more marked in the rheumatoid arthritis patient, but it is also more prolonged, as shown by the slower return towards normal after removal of the extremity from the cold water. In figure 3, it is noted that 75 per cent of the normal subjects had a 50 per cent or greater return to the control level within five minutes, while only 54 per cent of the rheumatoid arthritics had a similar return.

Contrast baths given to the hands of the rheumatoid arthritis patients cause significant changes in the amount of vasoconstriction of the small vessels in the fingers following cold stimulation. This was evidenced by a significant decrease in the fall of the cutaneous temperature of the fingers following immersion in cold water. This decrease in response to cold was already present after one week of contrast bath therapy and remained at this level during the remainder of the period of therapy. It is strongly suggested that the active alternate contraction and relaxation of the smooth muscle of the arteriole was the important factor in causing this change. It is interesting to note that the ,sensitivity to cold, as evidenced by fall in cutaneous temperature, was decreased by contrast bath therapy, whereas the subsequent slow response to a room temperature of approximately 25 C. was unaltered. The lack of relation between these two phenomena — degree of fall in cutaneous temperature and rate of return to normal — is further illustrated by the scatter diagram (figure 3) of the arthritic patients. The magnitude of decline in skin temperature was as great in the patients who had a rapid return to normal as it was in those with a slower return.

There did not appear to be any correlation between the decrease in the cutaneous temperature or the rate of return to normal of the cutaneous temperature following cold stimulation and the clinical condition of the patient. This finding appears to be similar to that of most other investigators in this field. The majority of the patients received no remarkable relief clinically from the contrast bath treatments.

Summary

1. At a room temperature of approximately 24.5 to 25.0 C. the average cutaneous temperature of rheumatoid arthritis patients was the same as that of a group of normal controls.
2. The decrease in cutaneous temperature following immersion of the hand in cold water at 15 C. for one minute was greater in the arthritis patients than in the controls, while the rate of return of skin temperature to the pre-cooling level was slower in the arthritis patients.
3. Contrast baths to the hands, in patients with rheumatoid arthritis, significantly decreased the fall in cutaneous temperature following a cold stimulus, but it did not appreciably change the rate of return of the cutaneous temperature to the pre-cooling levels.

Discussion

Dr. Jesse G. Jenkins (Temple, Texas): I wish to congratulate Dr. Fricke on his paper and the work that he has done. He has spent a good deal of energy and time in doing the work he has accomplished.

M. M. Ernst and D. H. Collins made the following observations: "Poor reaction to contrast baths appears associated with the more severe and acute states of rheumatoid arthritis. We have never encountered a poor reaction in healthy males. Rather do we believe that the sluggish adaptability of the peripheral circulation in severe cases of rheumatoid arthritis in men is a consequence of the disease.

"Females without any arthritis and apparently in good health fail to react in an adequate manner to the contrast bath tests. In females who have rheumatoid arthritis the poor reactions may be due to the vascular dysfunction and not to rheumatoid arthritis."

Collins' data make it certain that the preexistence of vascular defects, although they may favor a graver form of the disease and be prejudicial to its recovery, is not an essential factor in the onset and development of rheumatoid arthritis in either sex.

Lewis noticed that the palmar tips of the thumb responded more rapidly to the heat than did the dorsal surface. This may be attributed to the greater number of arteriovenous anastomoses in the palmar surfaces, which augment and curtail the blood flow. Collins does not believe that a vascular disorder is the primary cause of rheumatoid arthritis. Infection still appears to be the primary cause.

With the work we have done at the Scott and White Hospital Clinic and at Temple we have been more or less in the field of treating patients, and have not gone into the field of experimental work or testing out in this particular line. We have used contrast baths in the treatment of rheumatoid arthritis, using hot water at 42 C., 107.6 F., and the cold water at 12.5 C. or at 53.6 F., and it appears that sometimes these patients receive some benefit from the standpoint of taking care of the pain at the time. In other cases the pain was made more severe, and they were unable to stand it.

These baths were advised for patients who went out. In our clinic we are not able to keep the patients over a long period of time, it being a private clinic. We go out to the homes in the various parts of the country. On some we get later reports, but on others we do not, and for that reason I am not able at this time to give any definite figures on what results we are getting from rheumatoid arthritis treatment in the form of contrast baths.

With some patients, contrast baths with a spray are used. By this spray method we find that six minutes in hot water and four minutes in cold water has proved to be about the most satisfactory timing, and the use of a spray over the affected part with hot water, switching to a spray with cold water sometimes makes it better and more convenient for the patients when they have tubs at which they can connect the hose. Others we ask to simply immerse their hands in two tubs, one with hot water and one with cold.

Dr. Harry Samberg (Des Moines, Ia.): I think one of the important points in this connection, since physical medicine has to go through a great many forms of investigation, namely, the importance of this question, is not so much how much decrease there is, but what the end result is over a period of treatment.

Dr. Fred J. Fricke (Fort Logan, Colo., closing): I might make one statement in regard to the clinical aspect of this as a clinical response from this treatment:

Out of the ten patients we tested and on whom we ran contrast bath treatments, there was one that had remarkable results subjectively, other than the results you saw on the tables. Two others felt that they had some improvement, but the rest of them did not feel their hands were any better or felt any different after the contrast bath treatment.

IMPORTANT NOTICE

Nominations of candidates for Gold Key Awards may be made by any member of the Congress. A nomination should include a brief statement of the achievements of the candidate and the reasons for his consideration by the committee appointed to select the recipients of the award. Nominations should be sent to the Executive Secretary of the American Congress of Physical Medicine by May 1, 1952.

ELECTROMYOGRAPHIC RECORDING OF MUSCULAR ACTIVITY IN NORMAL AND SPASTIC GAITS *

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and
MORTON NATHANSON, M.D.

NEW YORK

Approximately 75 per cent of the 250 patients examined at the Multiple Sclerosis Research Clinic of the New York University-Bellevue Medical Center had gait disorders primarily due to spasticity. This fact alone demonstrates the importance of spasticity as a disabling factor. Its presence in many of the chronic neurologic disorders makes spasticity a great challenge to rehabilitation. Braces and canes frequently improve the spastic gait but only to a limited degree. Other therapeutic measures such as drugs, exercise, and surgery have been employed extensively to improve the walking ability of these patients. Their effectiveness is questionable.

Actually, the criteria for judging the effect of any of these therapeutic methods are for the most part based on subjective evidence. In order to evaluate more objectively the effect of therapy on spastic gaits, the pattern of muscular function during ambulation was studied. This was done by recording the electric activity of the important muscle groups involved in walking, employing a method similar to that used at the University of California.[1]

Method and Material

Small skin electrodes (metal discs of ¾ inch diameter) were applied with adhesive tape over the muscles to be examined. Thin wires connected these electrodes to a channeling box which the subject carried on his back. A ten foot cable connected the box with the recording machine, a Medcraft 8-channel ink-writing oscillograph (Fig. 1). This arrangement allowed the subject to walk freely back and forth for a distance of 20 feet. Two microswitches attached to the sole of the shoe produced signals which demarcated the swing and the stance phase (Fig. 2). These signals were recorded in one channel of the oscillograph. The other channels recorded the electric activity of the seven major muscle groups of the lower extremity. A preliminary study showed complete synchronism in the contraction of all muscles of the same group during walking. Therefore, only one muscle was chosen from each group for recording of action potentials in the following way:

1. Hip extensor group: gluteus maximus; 2, hip abductor group; gluteus medius; 3, hip adductor group: adductor longus; 4, knee flexor group: semitendinosus; 5, knee extensor group; vastus lateralis; 6, calf muscles; inner head of gastrocnemius; 7, pretibial muscles: tibialis anticus.

Since the mechanical effect of muscular contractions coincides, for all practical purposes, with the electric activity in the contracting muscle, the electromyogram allows us to analyze the pattern of muscular activity.

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* From the Departments of Neurology and Physical Medicine and Rehabilitation, New York University College of Medicine. Supported by a grant from the National Multiple Sclerosis Society.

* Read at the Twenty-Ninth Annual Session of the American Congress of Physical Medicine, Denver, Colo., September 7, 1951.

[1] University of California: Prosthetic Devices Research, vol. 1, chap. 3, 1947.

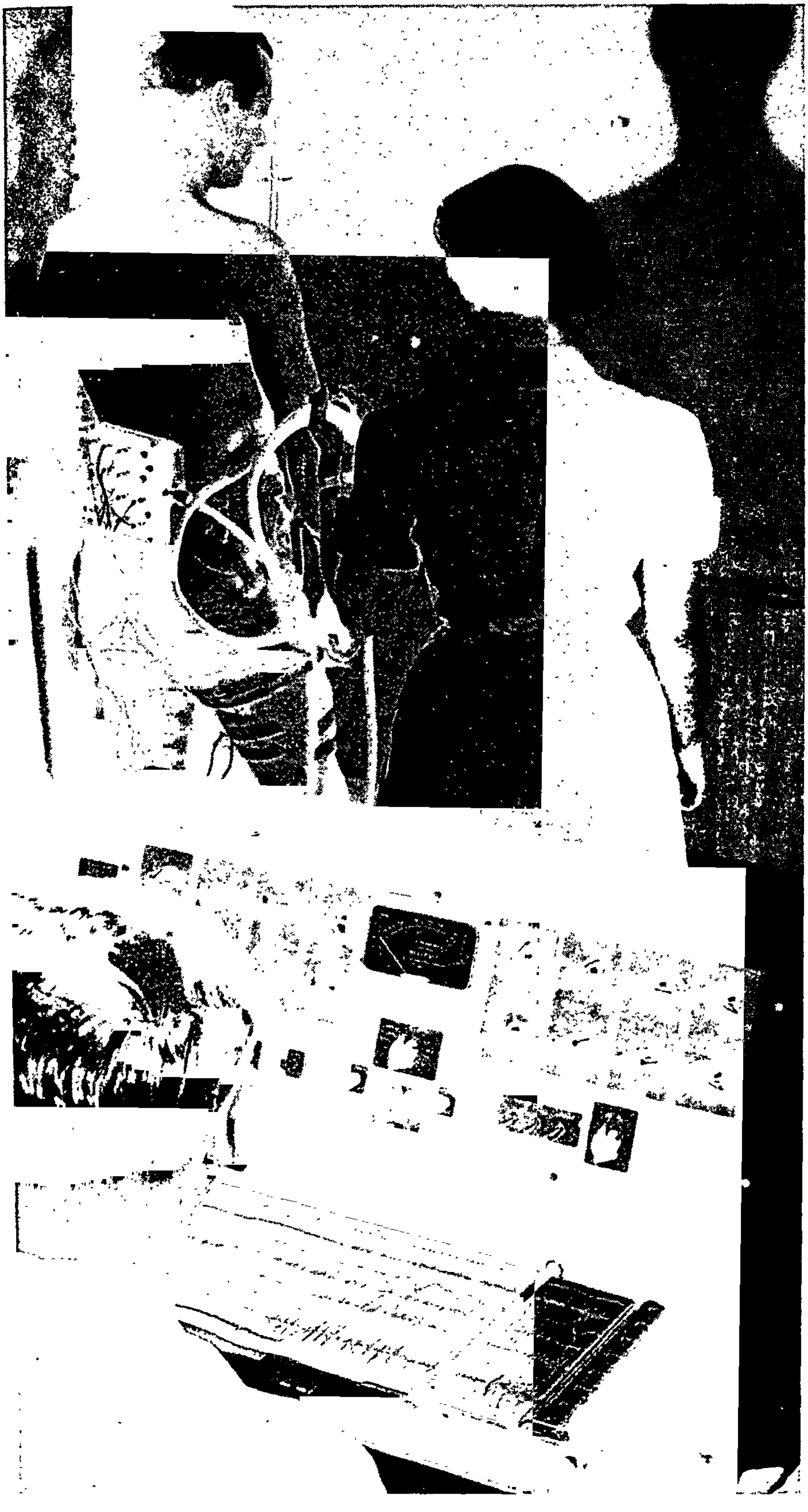

Fig. 1. — Technique of electromyographic recording. — The muscle action potentials are picked up by metal electrodes which are attached to the skin over the muscle with adhesive tape. Thin wires connect these electrodes with a channeling box. The latter is connected to the recording machine by a ten foot cable. Thus, the patient can walk freely for a distance of 20 feet.

Fifteen normal subjects, eleven hemiplegics, and thirty-six patients with spastic paraparesis were studied. The etiology was cerebro-vascular accident in the cases of hemiplegia, and multiple sclerosis in the paraparetics. The subjects walked on level ground in their usual manner. Recordings of the gait in each subject were made repeatedly at varying intervals in order to determine and verify the basic patterns. In some of the paretic subjects comparative electromyograms of gait with and without cane or short leg brace were taken. Several patients had electromyograms before and after intravenous injections of amobarbital sodium (Amytal^{R} Sodium) (2 to 3 grains in 2 minutes) or mephenesin (Tolserol^{R}) (50 cc. of a 2 per cent solution). One patient had electromyographic gait studies before and after obturator neurectomy. The effects of exercise and massage were also studied.

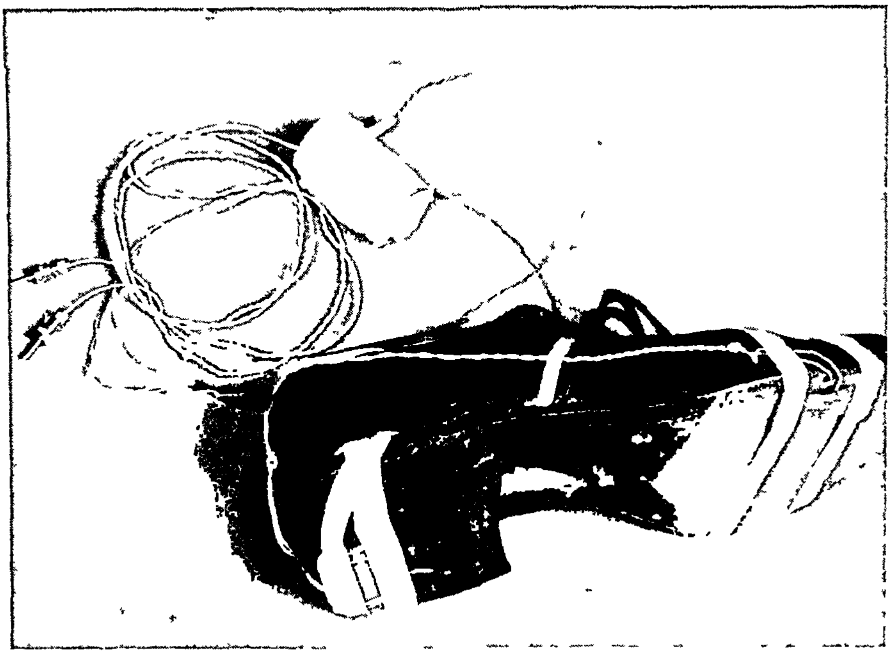

Fig. 2 — Recording of stance and swing phase — Micro switches attached to the sole and heel of the shoe are connected to one channel of the oscillograph where they produce a signal at the beginning and at the end of the stance phase

Results

Normal Subjects. — In the normal subjects a consistent pattern of electric activity was found (Fig. 3). Only one muscle group, the calf muscles, started to contract in the middle of the stance phase. This group was the most active one in the normal gait as shown by the high amplitude of its tracing. Six muscle groups, including the hip muscles, the quadriceps, and the hamstrings, showed electric activity during the transition from swing to stance phase. Of these muscles only the gluteus medius continued to contract beyond the middle of the stance phase. The others ceased contracting within the first third of this phase. At the transition from stance to swing, the adductors and, in some cases, the hamstring group contracted. During the swing phase only the pre-tibial group was found to be active. Frequently a burst of activity of the gastrocnemius was found in the center of the swing phase. The patterns of electric activity in both legs were identical in the normal.

Patients With Hemiplegia — In patients with hemiplegia the paretic extremity showed a prolonged swing phase and decreased activity of all muscles

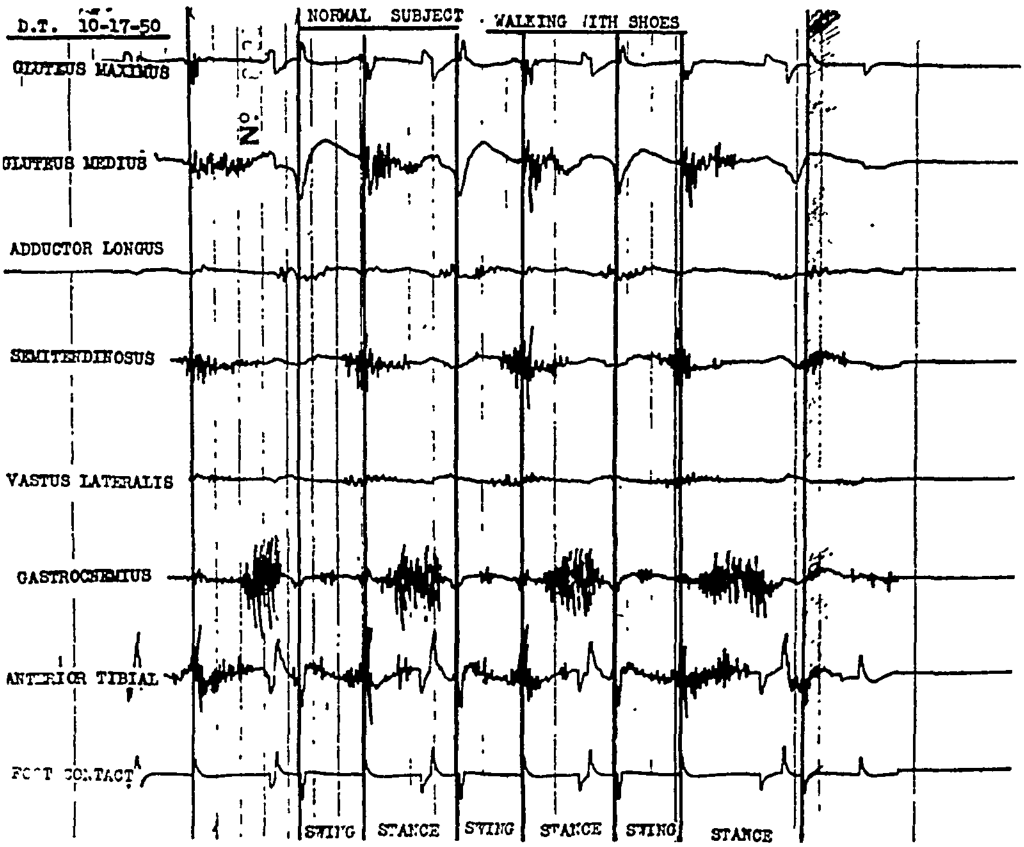

Fig. 3. — Electromyographic pattern of normal gait. — At the transition from swing to stance all muscles contract. During the first third of the stance phase the gluteus medius, gluteus maximus, adductor longus, and semitendinosus are active. The gastrocnemius contracts in the middle of the stance phase. At the transition from stance to swing only the adductor longus is active. During the swing phase the anterior tibial shows variable activity and frequently there is a burst of activity of the gastrocnemius during the middle of the swing phase.

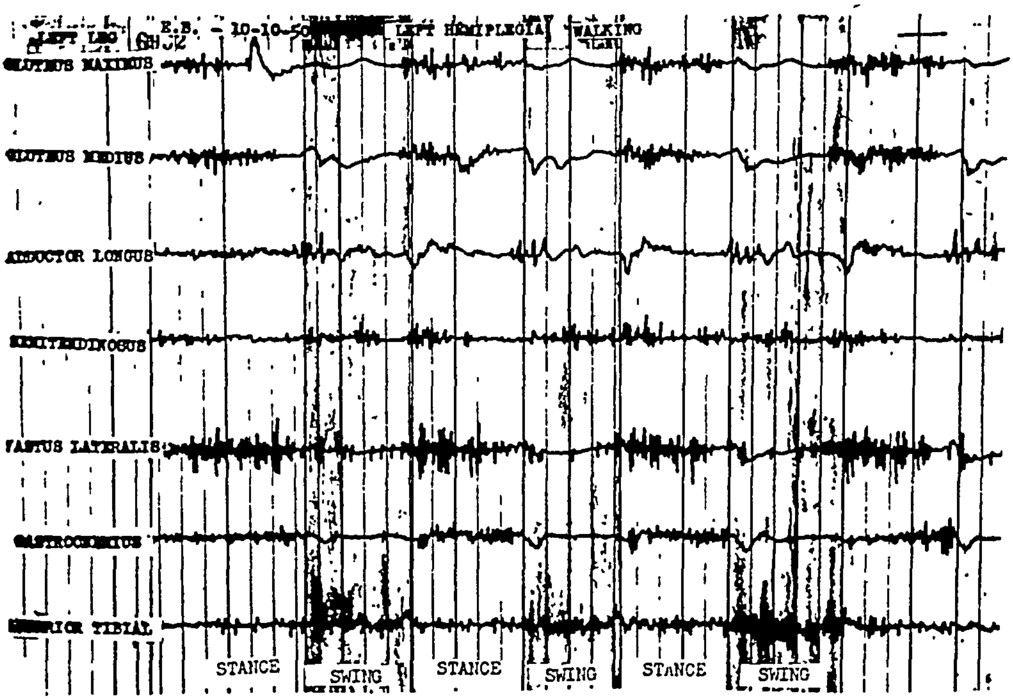

Fig. 4. — Example of electromyographic pattern of the involved lower extremity in a patient with marked hemiparesis showing: 1. Prolonged contraction of the semitendinosus and vastus lateralis during the stance phase. 2. A low amplitude of the contraction of the gastrocnemius. 3. Activity of the gastrocnemius from the end of the swing phase to the end of the stance phase. 4. Generally decreased muscular activity and prolonged swing phase.

(Fig. 4). The most active muscle groups in this extremity were the quadriceps and the hamstrings. Their contraction began at the final portion of the swing phase and lasted until the end of the stance phase. The amplitude of the tracing of the calf muscles was low and uniform. The onset of their contraction coincided with the beginning of the stance phase and the cessation of their activity with the end of this phase. The hip muscles deviated only little from the normal pattern.

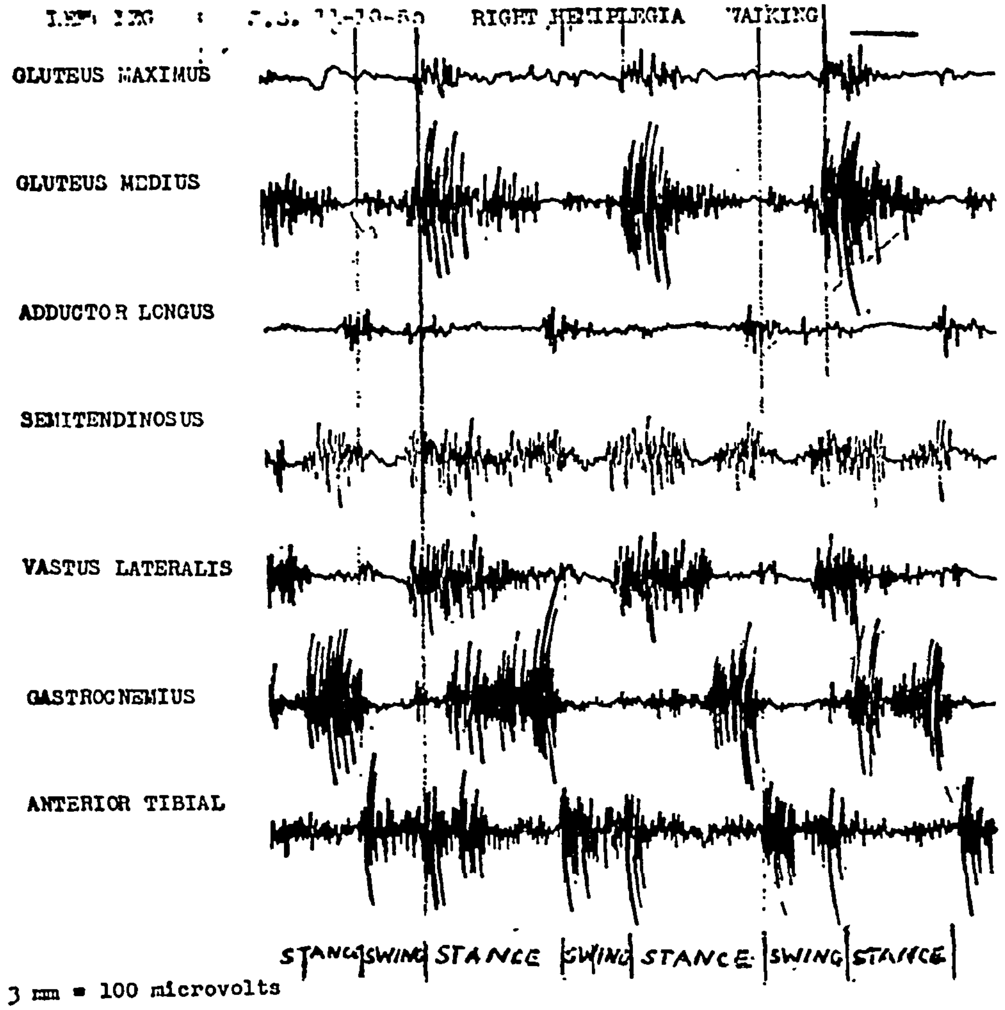

Fig. 5. — Electromyogram of the non-paretic leg of the patient shown in Fig. 4. — This pattern is characterized by: 1. Generally increased muscular activity. 2. Shortened swing phase. 3. Prolonged activity of the semitendinosus and vastus lateralis. 4. Contraction of the gastrocnemius from the end of the swing phase to the end of the stance phase.

The non-paretic limb of the patients with hemiplegia showed a shortened swing phase and increased activity of all muscle groups especially of the gluteus medius (Fig. 5). The timing of electric activity resembled more that of the paretic limb than that of a normal one. For instance, the quadriceps and hamstring groups were active throughout most of the stance phase. Furthermore, the tracing of the calf muscles was uniform in amplitude and began with the stance phase in most instances.

Patients With Spastic Paraparesis. — Unlike the normal subjects and the patients with hemiplegia, the tracings of those with spastic paraparesis showed unpredictable and varied patterns (Fig. 6). There were marked differences not only between one patient and another, but also between the two limbs of the same patient. However, a given extremity showed a consistent pattern on repeated examinations. Despite the differences in pattern, some characteristics were common to almost all of the tracings, and may be considered typical of the gait in spastic paraparesis. First, the calf muscles contracted only weakly. Secondly, these contractions occupied the entire stance phase. Finally, powerful contractions of the quadriceps and the hamstring muscles were recorded from the latter portion of the swing phase to the end of the stance phase. These characteristics were noted in over 75 per cent of this group.

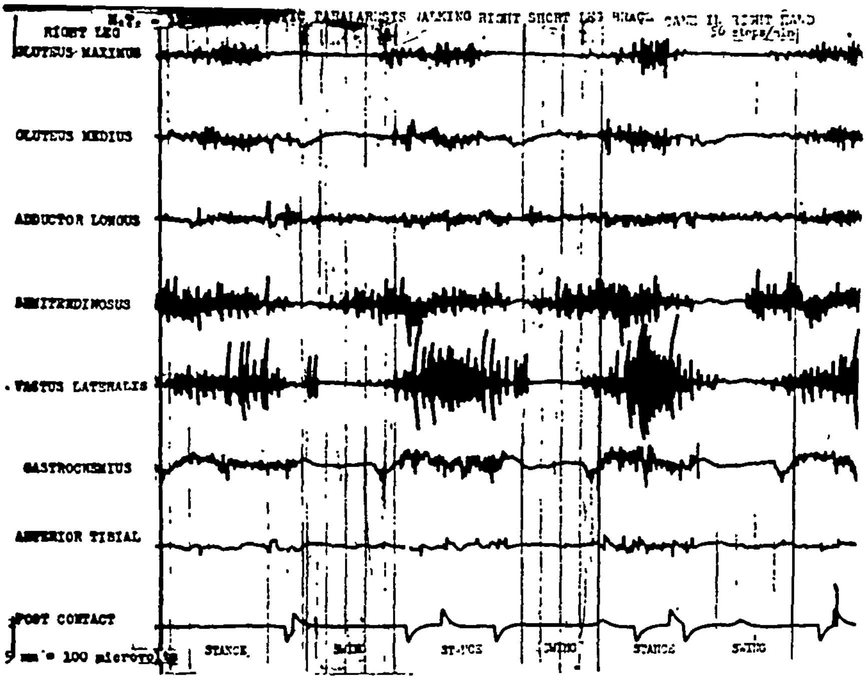

Fig. 6. — Electromyograms of a patient with spastic paraparesis. — In patients with spastic paraparesis, the pattern of muscular contraction is less uniform than that of hemiplegia and normal subjects. However, a prolonged contraction of the semitendinosus and vastus lateralis, and a contraction of the gastrocnemius throughout the whole stance phase are most commonly seen.

Effects of Therapy

Electromyograms were taken prior to and after various forms of therapy. It was found that prolonged periods of exercise produced no change in the patterns of electric activity. Neither did the use of braces and canes produce any significant changes in this pattern, in most instances. In a case of obturator neurectomy for relief from adductor spasm, the postoperative electromyogram showed a marked reduction in adductor activity as compared to the preoperative record. The pattern of the other muscle groups, however, remained unchanged.

Three patients were given intravenous injections of Sodium Amytal^{R}, and one patient received intravenous Tolserol^{R}. No effect upon the pattern of muscular activity could be ascertained. However, the number of cases is insufficient to make a definite statement.

Comment

Our findings in normal subjects are identical with those of other investigators[1] and indicate that there is considerable uniformity in the pattern of muscular activity of the lower extremities during normal gait.

An unexpected finding in the hemiplegic patient was a striking similarity in the pattern of muscular contraction of the non-paretic limb to that of the paretic one. Although this phenomenon may be produced in part by mechanical factors, it is believed that cerebral dysfunction is responsible for the abnormalities found in the non-paretic limb. This concept is further supported by the findings of others. Stroboscopic and force-plate studies of gait[2] showed that the non-paretic limb has curves of vertical load and knee moment similar to those of the paretic limb. Also, Cohn[3] has shown that in patients with hemiparesis there is defective performance of alternating movements in the non-paretic upper limb similar to that of the paretic one. Investigation of the electric activity produced in the quadriceps by stretch of the patellar tendon[4] revealed that the knee jerk in the non-paretic limb was frequently abnormal in patients with hemiparesis.

Another important consideration is the contrast in the intensity of muscular activity between the paretic and non-paretic limbs of the hemiplegic. The decreased amplitude in the tracing of the paretic limb may be due to the actual weakness of the muscles, or to the fact that the patient does not rely on the stability of his paretic limb and therefore does not put any weight on it. The marked muscular activity of the non-paretic extremity shows that this limb supports most of the body weight. It must be emphasized that prior to this study all of the hemiplegic patients had had a course of rehabilitation including resistance exercises to the paretic limb. The fact that they still rely mostly on the non-paretic limb, despite this therapy, suggests that more attention should be paid to the training of the uninvolved side.

The great variability of muscular patterns in the patients with paraparesis might be readily explained by their varied sites of pathology. This may also explain the discrepancy between the two lower extremities which was frequently observed. However, the consistency of pattern of each limb of a given patient on repeated recordings, at varied intervals, is an important finding. It allows us to determine objectively whether or not a therapeutic measure has modified the pattern of muscular activity.

Long periods of exercise, as mentioned above, did not influence the pattern of electric activity, nor did it have any significant effect on the patient's performance. As a rule, the braces and canes did not change the pattern of muscular contraction either. However, at times they produced clinical improvement of the patient's gait. This effect is probably due only to mechanical support, but these appliances do not decrease the spasticity of the extremities as is sometimes believed. Drugs, such as Sodium Amytal^{R} and Tolserol^{R}, did not alter the pattern of muscular activity. Further investigation is in progress with these drugs and others, especially those for which effectiveness in relieving spasticity is claimed. Clinical trials have frequently led to false hopes as to the beneficial effect of drugs on spasticity and, therefore, more objective methods such as the one presented are in order.

Summary

A method of recording muscular activity during the act of walking is presented. The patterns of gait in the normal and in patients with spastic hemiparesis and paraparesis are described and illustrated.

Repeated recordings at various intervals showed a consistent pattern

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[2] Wortis, S. Bernard; Marks, Morton; Hirschberg, Gerald G., and Nathanson, Morton: Gait Studies in Hemiplegia. Presented before the American Neurological Association (June) 1951. In press for the transactions of the A. N. A.

[3] Cohn, R. Interaction in Bilaterally Simultaneous Voluntary Motor Function, Arch. of Neurol. & Psychiat, 65:472, 1951.

[4] Hirschberg, Gerald G., and Bergman, Philip S., Unpublished data.

in each individual. Uniform and characteristic patterns of muscular activity were found in the normal subjects and in the patients with hemiplegia (both in the paretic and non-paretic lower limbs). This method permits objective evaluation of the effectiveness of therapy aimed at alleviating spasticity.

Preliminary observations of the effects of exercise, braces, and drugs are reported.

Discussion

Dr. Edward M. Krusen, Jr. (Dallas, Texas): I am sure everyone agrees with me in thanking Dr. Hirschberg and his group for a fine piece of work on a most interesting subject of great significance in physical medicine.

The problem of spasticity is one familiar to us all. It is frequently discouraging to see a patient with good muscular strength who is unable to control his muscles because af spasticity. It has been most encouraging for the clinician in physical medicine to note the number of fine papers on this subject in this Congress.

Dr. Hirschberg's paper work with hemiplegic patients appeared particularly significant to me. It is interesting to note that most pronounced changes in electromyographic recordings were in those muscles that are generally most seriously involved in disability.

In this connection I have a question to ask Dr. Hirschberg: I am wondering if he noted a consistent reversal of electromyographic activity of the quadriceps and hamstrings.

It appears to me when I look at these recordings that in the normal individual there is very little activity of the quadriceps and a rather high, although not very prolonged, activity of the hamstring muscle groups in the transition from the swing to the stance phase. On the other hand, a hemiplegic patient appears to have rather marked activity in the quadriceps; and while there is a prolonged activity of the hamstrings, it is not very intense.

The fact that abnormal findings were noted on the uninvolved side would be of great practical significance. It should make us more conscious of the necessity for bilateral training. It also should stress timing, particularly of the stance and swing phase.

Paraparesis of multiple sclerosis is often one of the most discouraging problems in physical medicine practice. It is interesting to note that in Dr. Hirschberg's findings rehabilitation and training did not change the electromyographic patterns. This was noted in spite of the fact that clinical functional improvement is frequently seen. Without doubt the study of the effect of drugs on spasticity is of great clinical importance

A great deal of difficulty would be avoided if spasticity could be overcome effectively. It is to be hoped that Dr. Hirschberg and his group will continue this valuable study until more effective means of controlling spasticity have been found.

Dr. Gerald G. Hirschberg (New York): I thank Dr. Krusen very much for his kind comments. It is true there is a reversal of hamstring activity. not only in hemiplegics but also in paraplegics.

We have done some purely mechanical studies on hemiplegics, such as force plate studies, to determine the total vertical load, and the knee movement. In those studies we have found that the hemiplegic, for all practical purposes, does not bend his knee when he walks. The hemiplegic walks as if he had a peg leg. This is not only true for the paretic limb, but also for the non-paretic limb.

If the hemiplegic keeps his leg entirely stiff it is understandable that the quadriceps might contract; in fact, I think the powerful contraction of the quadriceps in the hemiplegic gait is rather the cause of the peg leg walking rather than a consequence of it.

In the paraparetics, on the other hand, the greater quadriceps activity is due to the fact that these patients have a slight knee flexion contracture, and walk with bent knees. It requires a great deal of quadriceps action to walk with bent knees to maintain equilibrium.

Dr. Harry Samberg (Des Moines, Ia.): Before asking two questions I would like to preface my remarks with a little discussion.

Those of us who have dealt with hemiplegics and who have tried to consider them intensively, have, in addition to braces, added a heel lift to the uninvolved side. That throws them over more toward the involved side, and gives them better balance.

A second and very important point which I have noticed, and which I think is very often not realized and is omitted in training, is that the first thing that occurs in walking is a forward loss of balance. If you watch many of these hemiplegics you will see they do not seem to roll forward when they walk, but stand more vertically and bring their involved leg forward, which keeps the knee extended.

I would like to ask Dr. Hirschberg whether in their training this has been taken sufficient cognizance of, and whether he has also included a lift on the uninvolved side before the electromyograms were done.

Dr. W. Darley (Denver, Colorado): This is a very interesting presentation of gait. I wonder if the authors have tested or taken gait patterns of normal individuals who were good imitators and who simulated these gaits, to see whether it is a mechanical or a neurological factor.

Dr. W. B. Snow (New York): I would like to ask Dr. Samberg if this is due to the fact that they do not swing their arms. You know, we do not walk only with our feet.

Dr. Gerald G. Hirschberg (New York): We have not tried the heel lift; I think we will. I suppose you realize that this is actually a preliminary study, and we intend to use much more mechanical means.

Dr. Darley's suggestion has been tried. We have used a knee cage to lock the knee. So far we have checked three normal individuals. So far the test is not conclusive. One of them produces a pattern that is fairly similar to the hemiplegic, but the other two produce a pattern that is quite similar to the normal.

FEDERAL CONTROL OF MEDICAL DEVICES [*]

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Protection of the consumer against misbranded and adulterated devices is broadly provided by the Federal Food, Drug, and Cosmetic Act which is enforced by the Food and Drug Administration. Two other Federal agencies serve similarly to protect the public. The Federal Trade Commission offers protection against unfair competition and deceptive practices in advertising and the Post Office Department through its Fraud Section takes actions to prevent fraudulent use of the mails. This paper will be devoted to the activities of the Food and Drug Administration as they deal with the labeling of devices.

Although the word "device" does not appear in the designation of the Act, devices share equally with foods, drugs, and cosmetics in the enforcement activities of the administration to promote compliance with statutory requirements. The term "device" as set forth in the Act means instruments, apparatus, and contrivances, including their components, parts, and accessories, intended for use in the diagnosis, cure, mitigation, treatment, or prevention of disease in man or other animals or to affect the structure or any function of the body of man or other animals. For practical purposes, except for the declaration of active ingredients, labeling requirements for drugs and devices are the same. A device is misbranded if its labeling is false and misleading in any particular.

The greatest gains in proper labeling of devices have been made by the manufacturers who adhere voluntarily to the statutory requirements. Unfortunately, in the device field there are many improperly branded articles currently being offered for sale by unscrupulous merchandisers and unqualified gadgeteers for use by the public as well as by professional workers. Effective control of such violations requires substantial technical information and cooperation from the scientific groups who have special expert knowledge.

The types of violations which are encountered and proceeded against range from completely worthless therapeutic and diagnostic devices with fantastic health claims to recognized and useful machines for which unwarranted representations are made.

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[*] Presented at the 29th Annual Session, American Congress of Physical Medicine at the Shirley Savoy Hotel, Denver, Colorado, on September 5, 1951.

The "Plastic Dumbbell"

A representative device of the first class was the basis recently of an involved court action. This unit, which was purported to be based on the latest scientific principles, was popularly referred to as a "plastic dumbbell." It consisted of two plastic water tumblers filled partially with water, sealed with paraffin, joined at their mouths by scotch tape, and set into paraffin in the bottom of plastic baby rattles. It was claimed to introduce into the human body the energy given off by "expanded hydrogen atoms" alleged to be present in the liquid sealed in the tumblers. The user was to hold the article in his hands keeping the feet flatly on the floor without crossing the legs, or while reclining. This, it was claimed, caused the atoms of the body to expand and bring health through the hands. This article, costing $50, was offered to correct obesity and abnormal thinness due to glandular malfunctioning, correct diarrhea and constipation, reverse the aging process, rejuvenate the user, and cure "any disease known to mankind."

Presentation of this case in court necessitated extensive preparation on the part of the Administration, since the burden of proof is on the Government in any action it brings. Physicists were engaged to test the physical properties of the device for its energy output. Persons with diseases diagnosed and treated by physicians who had, on their own, used the device for its curative effects were sought out as well as their personal physicians, who were requested to testify as to their diagnoses in order to establish the lack of clinical value of the device. In addition, recognized experts in medicine were asked to undertake special clinical testing in certain diseases in order to establish further the lack of usefulness of this device.

The jury returned a verdict of guilty against the defendants after a week's trial in Federal district court, during which the physicists presented accurate data showing that the device gave off no measureable energy; the lay users, supported by testimony of their personal physicians, related their experiences as to the ineffectiveness of the device, and the medical experts testified as to the worthlessness of the article.

This case readily demonstrates the extensive preparation which is required generally to establish the worthlessness of a single device which patently is misrepresented. It must be recognized, furthermore that there are many devices still considered violative, in spite of the large number which have already been brought into compliance with the Act.

The Work of the F. D. A.

In reviewing the labeling for a device intended for lay use, it must be kept in mind that representations are not addressed to the medical profession but, in the terms of one court decision, "to the old and young, sick and well" who constitute the general public and are not aware of the limitations of the particular device. It should be stressed that in consideration of any labeling, all related information dealing with the article must be reviewed in order to be certain that amplification and unwarranted significance are not given elsewhere to the claims.

In the consideration of the therapeutic claims, adequate directions for efficacious use of a device are essential unless adequate directions are known by the ordinary individual.

Devices which cannot be used safely or efficaciously without medical supervision, surgical instruments, and devices to be used exclusively by physicians in their professional practice may be exempt from bearing directions for use if they are to be dispensed by physicians and information adequate for their use is readily available to the physician. In this class would be included devices such as diathermy or ultraviolet lamps other than for tanning. In order to avail himself of the exemptions from adequate directions, the manufacturer must meet additional definite requirements set forth in the regulations.

Adequate warnings are required to safeguard users particularly in pathological conditions or by children where danger to health may arise or against unsafe dosage, method, or duration of administration. In our interest to aid manufacturers we have suggested certain warning statements for several types of devices. For infra-red heating units, we have proposed the warning statement "Do not use over insensitive skin areas or in the presence of poor circulation. The unattended use of infra-red heat by children or incapacitated persons is dangerous." For ultraviolet generators for home use the recommended statement warns "wear protective goggles during use to avoid eye injury. Serious burns may be caused by exposure in excess of recommended dosage. Do not use over skin eruptions except on the advice of your physician." Devices used for massage should bear a warning that the unit should not be used over swollen or inflamed areas, or skin eruptions. We have encountered a number of steam bath or Turkish-bath-type devices for which the following warning is suggested: "Elderly persons and those suffering from heart disease or high blood pressure should not use this device except on the advice of a physician." The fundamental aim of providing such information is to make the article safe for use.

We need information on the hazards that are encountered in the use of devices in order to further the protection to be gained by the safety provisions of the Act. It would be very helpful if instances of injury arising from the use of devices were made known to the Administration, whether or not the directions were followed. The compilation of such information may well indicate that additional warnings should be required to safeguard users of devices. Reports of untoward effects arising from any physical unit employed for its diagnostic or curative properties would be valuable in connection with our device program.

In the field of devices new uses are recommended for those already on the market and these require evaluation. Moreover, new devices are being investigated for the first time. Although the Act does not require any formal application to establish the safety of new devices, such as is prescribed in the case of new drugs, the responsibility of the manufacturer or distributor is equally applicable. Currently the clinical application of ultrasonics is being investigated. Certain devices submitted for import have been released by the Administration with the understanding they are for use only by experts who are qualified by training and experience to investigate the safety of such devices. Only through critical study by well trained scientific workers will it be possible to establish the safety and clinical field of usefulness of these new devices.

To reconsider the problem of appropriate claims for devices, the view cannot be escaped that in the past the indications for use of many devices developed empirically. With the development of scientifically controlled methods of study we should be able to establish the field of use of a device under a particular set of circumstances. Among types of devices for reducing offered to the general user, for example, we encounter rollers, mechanical vibrators, massagers, electric stimulators, plastic suits, and steam baths, among others. Most of these units are claimed to bring about spot reducing, to mold the figure, and to give a new body contour. Such representations are all too frequently seen, and vendors of such equipment hold tenaciously that such body changes can be brought about. The scientific attitude does not support this expressed view, although the medical literature discloses only a few significant clinical studies to establish the lack of value of these varied modalities.

Outstanding examples of currently encountered fraudulent devices reveal the blatant therapeutic claims made for particular gadgets.

The Electreat

A device which has been the basis of a recent court action ending in the conviction of its manufacturer was called Electreat. This instrument looked like a flashlight with a roller on one end and several attachments which delivered an electric shock to the user. The manufacturer claimed that the apparatus would help arthritis, earache, menstrual disturbances, sleeplessness, nervous disorders, rheumatism, heart attack, and paralysis. After an 8-day trial in Federal court, during which medical experts testified as to the worthlessness of the article for such conditions, the jury found the defendant guilty.

The Magic Spike

Another device which attracted wide publicity because of its unwarranted claims was popularly called the "Magic Spike." Its promotion represented one of the most shameful attempts to cheat the public at the expense of their health which the Administration has brought to the Federal Courts. The "Magic Spike" or Vrilium Tube, the defendants claimed, had radioactive powers that would cure disease when it was worn on the body. Purchasers were using it for cancer, diabetes, leukemia, thyroid disturbances, ulcers, arthritis, and other serious diseases. The gadget is a brass tube two inches long and about as thick as a tally card pencil, with a safety pin attached. It sold for $300. In it is a tiny glass tube filled with barium chloride worth 1/2000 of a cent.

Thirty-five scientific experts testified for the Government to show that the "Magic Spike" was incapable of treating or curing diseases. Most pathetic of the lay-user witnesses was the man who described the death of his diabetic son who abandoned insulin and placed his faith on the "Magic Spike."

In sentencing the defendants Judge LaBuy of Chicago, who heard the case, said "the sale of the device constitutes a gross fraud on the public. You have imposed on the poor sick who in their anxiety for relief would try anything at any price. You have fooled the trusting, the credulous and the gullible. The quackery you have employed is the more despicable because those who were deceived into believing in your fake remedy failed to pursue the treatment proven by medical science to be effective in preventing and curing diseases. The credulous belief in the efficacy of your useless product is the greatest danger inherent in quackery. It discourages and prevents those who use it from seeking proper medical treatment and the results of such neglect are often fatal."

The defendants in this case were each sentenced to a year in jail, fined $1,000, and ordered to pay the cost of the trial which lasted from March 20 to April 6, 1950. The firm also was fined $1,000.

Polizer's "Miracle"

Another contested case dealt with a device known as Polizer, Miracle of the Ages. It consisted of a glass container not unlike a Kjeldahl flask, cemented to a metal cylinder holding a small amount of mercury. This gadget was to be rotated over the diseased part or agitated in water or other liquids taken by the user. It was offered to "normalize" the body against a great variety of diseases including arthritis, sinusitis, eczema, constipation, hay fever, diabetes, asthma, high blood pressure, low blood pressure and many additional diseases. Again medical experts and outstanding physicists presented scientific testimony to establish the worthlessness of the product. In view of the age and income of the defendant, a fine of only $100 was imposed. Following the Federal action, the State brought a case against the defendant for practicing medicine without a license. This case is now pending.

Cooperation of the American Congress of Physical Medicine

In the development of cases for court presentation, it may become necessary to have tests performed in order to offer substantial evidence. Although we may rightly assume that the claims are invalid, in order to develop the most convincing case, appropriate tests are often needed to demonstrate objectively the lack of value or field of use of a device. The American Congress of Physical Medicine represents the professional group which can properly and most effectively undertake such testing. In the past we have had such professional cooperation. As our regulatory program expands it will depend in a large measure on the working together closely of the experts in physical medicine and the Food and Drug Administration in conducting such tests. Furthermore, as various scientific and pseudo-scientific appliances are investigated by experts in physical medicine it would be of great help to have such data supplied to the Administration.

The Food and Drug Administration has obtained constructive guidance in the evaluation of labeling of devices for several years from the Committee which the American Congress of Physical Medicine has set up to cooperate with the Administration, and has benefited greatly from this assistance. It is to our mutual interest to rid the market of worthless gadgets and to provide truthful labeling for the safe use of devices. While this special group has helped us solve many problems it should be stressed that only with full cooperation of all members of the Congress can the Administration maintain proper labeling for devices in the interest of the public welfare.

Discussion

Mr. Howard Carter (Chicago): The paper by Dr. Kerlan points out the importance of the work of the Food and Drug Administration regarding the control of labeling for medical products which are placed on the market and sold to the public.

Before the present Act was passed by Congress in 1938, control of the marketing of unwarranted and useless devices by governmental bodies was practically nil. It is true that the Bureau of Investigation of the American Medical Association accomplished much by advising the public on the value of nostrums, but the Bureau did not have police power or legal control. Repeated publicity by correspondence and published articles on the part of the Bureau, in many instances, brought about the decline of nostrums and the eventual withdrawal from the market of some of them.

The Administration apparently looks on a "device" as a "drug." The word "device" does not appear in the title of the Act. Whether this interpretation is an elastic use of the word "drug" remains for the future lexicographer to decide.

From the viewpoint of the Council on Physical Medicine and Rehabilitation, the work of the Food and Drug Administration in the control of misbranded quack devices is a great help to the medical profession, enabling the Council to devote its time to clinical problems having more scientific approaches to the treatment of disease.

Dr. Irvin Kerlan (Washington, D. C.): I would like to make one point: Mr. Carter indicated that he questioned whether or not we had authority over devices. What I said was that although in the designation of the Act the word "device" does not appear, it is appropriately defined in the Act and its regulations and all of the law which is written specifically makes reference to "devices."

It so happens that for practical purposes all of the requirements with regard to drugs, except for the new drug provisions and the declaration of active ingredients, are entirely parallel for drugs and devices.

WEAK THUMB OPPOSITION DUE TO POLIOMYELITIS

New Devices to Increase Function

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It has been estimated that the loss of function of the thumb results in 40 per cent loss of function of the hand.[1] Opposition of the thumb is a highly specialized motion in man.[2] It is performed mainly by the co-ordinated function of the muscles of the thenar eminence, namely: The abductor pollicis brevis, flexor pollicis brevis, opponens pollicis, and adductor pollicis. It should be pointed out that all of these muscles, with the exception of the opponens pollicis, produce flexion at the first metacarpophalangeal joint. Contraction of the opponens pollicis, which is inserted along the radial border of the first metacarpal, produces motion at the carpometacarpal joint pulling the thumb across the hand and rotating the metacarpal in a manner resembling pronation of the forearm.[2-3-4-5-6] Contraction of the flexor pollicis longus adds force and stabilization to the movement. The abductor pollicis longus both abducts and extends at the carpometarcarpal joint;[3] thus, it helps to initiate the act of forcing the thumb into the "grasp" position. However, it alone can not perform this act without the co-ordinated function of the muscles of the thenar eminence. Actually the abductor pollicis brevis is considered the primary abductor.[3] Neither can opposition be done adequately in the absence of the thumb abductors. In voluntary opposition, both the palmaris longus and palmaris brevis tighten the palmar aponeurosis augmenting the movement of the first and fifth metacarpal bones toward each other.[7]

If a poliomyelitis patient has a severely denervated hand, most of these muscle groups will be involved. The thumb will assume a position in which the first carpometacarpal joint will be adducted and extended. If allowed to remain in this position for a prolonged period, as commonly seen in patients confined in a respirator, the thumb adductors, abductor pollicis longus, extensors pollicis longus and brevis and first doral interosseous all become tight. This may cause marked restriction of opposition of the thumb even though there is some return of function to the muscles responsible for this act.

In an effort to solve this problem the "thumb stretcher" (figs. 1 and 2) was designed. Figure 1 shows the material before construction. The sponge-rubber gasket is cut into three sizes: large, medium and small to correspond with approximate hand sizes. A piece of gasket is then rolled up into the shape of a corn cob, and covered with broadcloth. The strips of canvas webbing are then sewed into place. When the need arises the device is fitted to the patient's hand (fig. 2), and the snaps are added. Enough tension

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1. Dunn, C. R.: Estimation of Permanent Disability, Minnesota Medicine 21:297 (May) 1938.
2. Bunnell, S.: Opposition of the Thumb, J. Bone & Joint Surg. 20:269 (Apr.) 1938.
3. Hollinshead, W. Henry: Functional Anatomy of the Limbs and Back, Philadelphia, Pennsylvania, W. B. Saunders Company.
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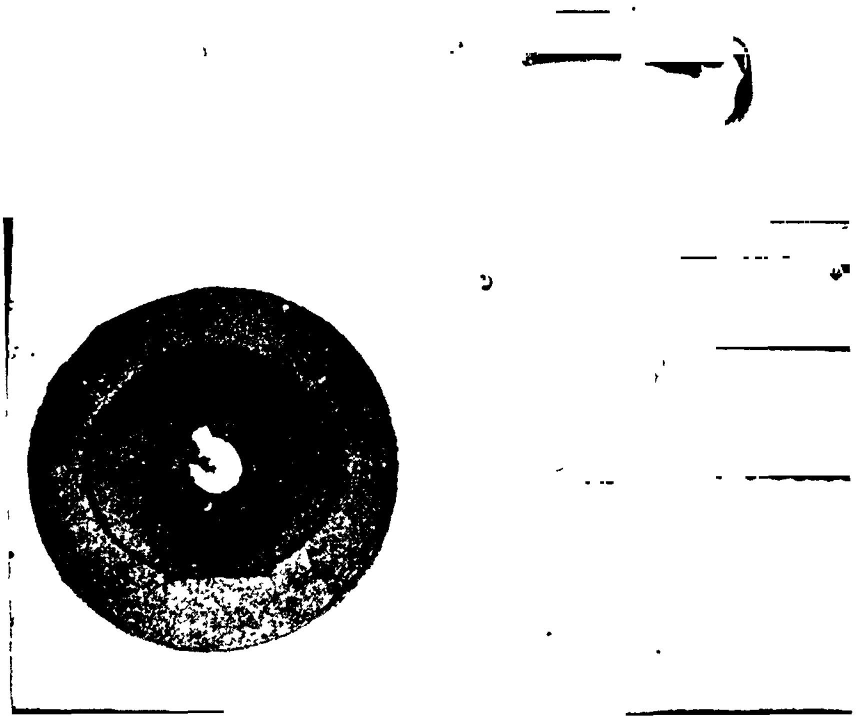

Figure 1. — Material used to make the "thumb stretcher" Left, worn sponge-rubber gasket from a respirator porthole; right, square piece of broadcloth, canvas webbing one inch wide and snap fasteners. Top, finished product.

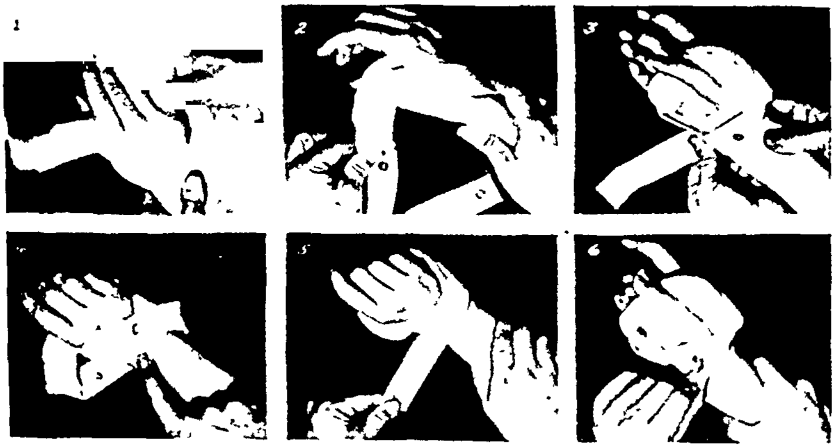

Figure 2 — Application of the "thumb stretcher." 1. The loop of webbing is slipped over the dorsum of the hand with the roll in the palm. 2 The loop of webbing is held in place while the thumb is forced into opposition. 3 The strap of webbing circles the wrist, and 4, is laced through the loop on the dorsum of the hand 5. The strap is pulled snug 6 The end of the strap is snapped into place Recently a snap has been added on the dorsum between the strap and loop of webbing This prevents the ulnar end of the roll from moving distally out of the palm

is placed on the webbing to obtain an effective stretch to the webb of the thumb but not enough to cause constriction of circulation in the hand.

Comment

This device has the following desirable features: It is made from inexpensive readily available material. It is simple in construction, easily fitted and applied, stays in place, and is cleaned quickly. If applied early, it prevents undesirable contractures. If applied after contractures are present, it effectively stretches the tight areas. Its usefulness to stretch tight areas can be applied when procedures are contemplated to improve opponens function, such as the use of an opponens splint, a tendon transplant to the thumb[2-8, 9] or a bony fusion in the thumb.

A New Opponens Splint

Many types of opponens splints have been tried by the authors. The undesirable features of these splints are numerous and include such objections as: being complicated, expensive, cumbersome; offering poor support for the thumb with reference to the position in which the thumb is held; preventing free motion at the metacarpophalangeal and carpometacarpal joints; being fragile, difficult to apply and remove, and uncomfortable.

The authors designed an opponens splint (fig. 3) in an effort to eliminate many of these objections. The material is aluminum alloy, and the splint is made from a standard pattern. The only necessary measurement is the distance between the second and fifth metacarpal heads measured on the dorsum of the hand. Another helpful measurement is the maximum distance between the first and second metacarpal heads. The greater this distance the better the function; thus, it is sometimes advisable to stretch tight areas, as mentioned above, for a short period before fitting the splint. The splint may prevent tightness from developing; but it is not designed to perform forceful stretching. The force pulling the thumb into opposition is regulated by tension on the rubber band (fig. 3, No. 4). The hinge placed over the dorsum of the second metacarpal (fig. 3, No. 6), allows the thumb to swing freely into opposition.

Comment

The opponens splint described is simple, inexpensive, light, durable, small; holds the thumb in a functional grasp position; allows free movement at the metacarpophalangeal and carpometacarpal joints; and is easily applied and removed. If fitted properly, it is comfortable to wear.

If the only function remaining in a severely denervated hand is slight finger flexion and that of the flexor pollicis longus, application of this splint will allow many light hand activities that would otherwise be impossible.

Thirty-eight patients having weak opposition of the thumb were fitted with the opponens splint during the period starting February, 1950 and ending May, 1951. Questionnaires were sent to these patients in an effort to evaluate the usefulness of the splint. Twenty-five patients returned their questionnaires answered. Two of these patients had median nerve lesions causing the weakness. The results of this follow-up study are given in table 1.

The period of follow-up of individual patients ranged from two months to fourteen months. Five patients had discontinued wearing their splint. The reasons were as follows: increased strength of the thumb in two patients;

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[8] Irwin, C. E.: Transplants to the Thumb to Restore Function of Opposition; End Results, South. M.J. 35:257 (Mar.) 1942.

[9] Royle, N. D.: An Operation for Paralysis of the Intrinsic Muscles of the Thumb, J. A. M. A. 111:612 (Aug.) 1938.

no return of function in one patient, with a complete median nerve lesion; pain on turning the wheel of the wheel chair was the fourth patient's reason; and a fifth felt it was "too bulky." The period each day for which the patients wore their splints ranged from thirty minutes to sixteen hours. Some patients wore their splints while sleeping. One patient reported that the only time the splint was uncomfortable was while he was sleeping. Twenty-two patients reported specific help by using the splint. Fifteen patients reported increased strength of the thumb.

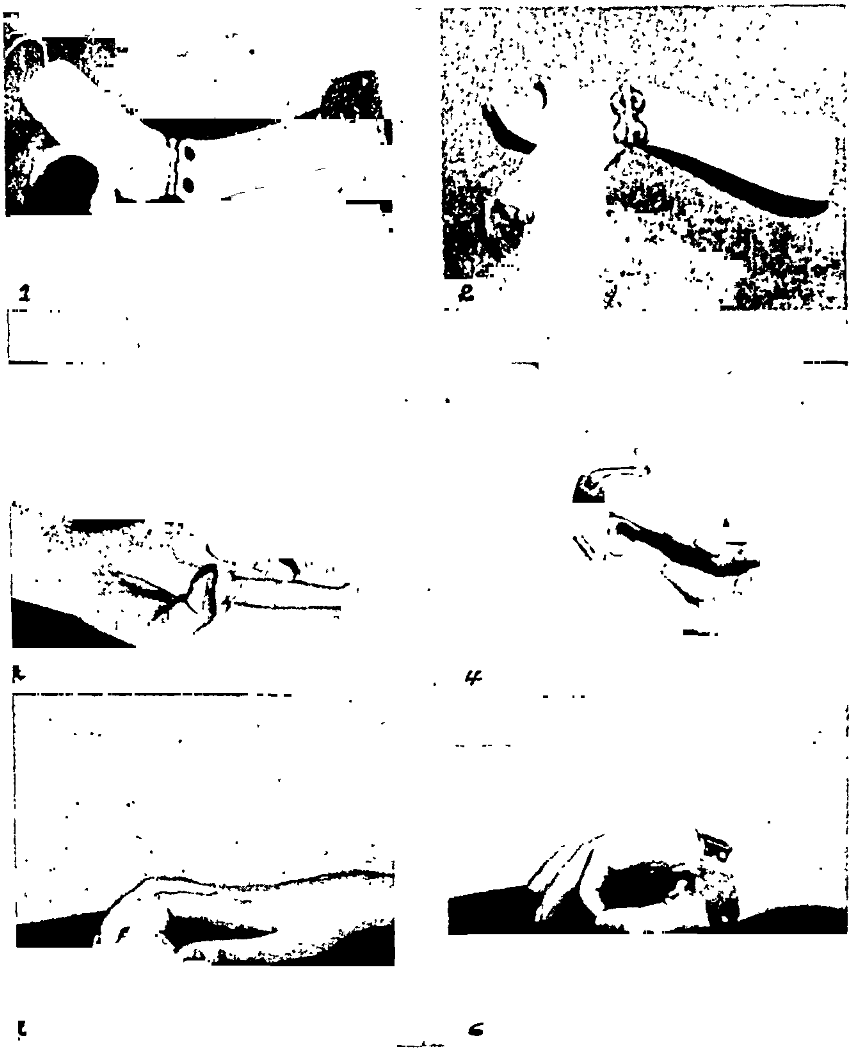

Figure 3. — Opponens splint. 1. Palmar surface. 2. Dorsal surface. 3. Weak opposition. 4. Splint in place. 5. Picking up paper clip without opponens splint. 6. Same act, wearing splint.

Many hand activities were mentioned by these patients as being enhanced

Table 1. — *Use of Opponens Splint.*

Follow Up of 25 Patients.

Average months of follow up	8.24
Still wearing splints	20
Average hours splint worn	5.8
No. reporting any discomfort	9
No. reporting benefit	22
No. reporting increasing strength	15

by wearing the opponens splint and include the following: writing, sewing, buttoning, eating, painting, leather work, knitting, picking up small objects, combing hair, playing piano, peeling potatoes, tying shoes, holding a book, picking up sandwiches, winding a watch, and holding a glass of water. Four activities were mentioned which were hindered by wearing the opponens splint. These include: walking with crutches, rolling own wheelchair, "no place to anchor pencil," gripping heavy objects.

It is the opinion of the authors that many of the complaints of discomfort and hindrance in activities could be alleviated by simple mechanical adjustments to the splint and on-the-spot supervision of activities.

Summary

The functional anatomy of the muscles involved in the act of thumb opposition is described. The disability resulting when these muscle groups are weak is pointed out.

A new device is described that has two purposes: One to maintain the thumb in the functional grasp position if hand weakness indicates the need. Two, if tightness is present in the webb of the thumb, the device effectively stretches the area thus assuring a maximum grasp position of the hand.

A new, simple, inexpensive, light, opponens splint is reported that allows maximum thumb motion while being worn. A follow-up study of twenty-five patients who were fitted with the opponens splint helps substantiate its effectiveness.

Acknowledgements. — The authors wish to thank Mrs. Harriet Dansforth, and other members of the staff of the Elizabeth Kenny Institute, Minneapolis, Minnesota, for their skilled assistance in helping to prepare the material presented. The authors are indebted also to Mr. C. E. Medcalf, Minneapolis, Minnesota, for his help in designing and making the opponens splint.

Discussion

Dr. H. L. Rudolph (Reading, Pennsylvania): May I take a minute to discuss the hand splint which was described in Dr. Worden's excellent paper. I am in accord with the use of any type of splint which can serve to maintain good functional position of the hand. I call your attention to the fact that most polio patients in this country are treated in hospitals which do not have ready access to brace shops and the construction of straps requiring snaps and the like is not as simple as it might seem. For this reason simplicity in splinting encourages splinting when necessary and as often as necessary.

During the past year, Dr. Huddleston described a hand roll which consisted of a cotton-filled piece of stockinette with an encircling piece of elastic tape permitting insertion of all fingers top and the thumb bottom. This has given me an idea for a type of hand roll which anyone can make in several minutes and has been used by us on several occasions with satisfactory maintenance of functional position of the fingers and thumb. As you can see, I am removing my socks. Rolled up in this fashion, and turning back one of the hems to hold the roll, a small bun is formed to fit the palm of the hand. My rolled-up handkerchief and two safety pins to fasten it to the bun complete a satisfactory hand roll for use in the home and even the hospital. With a little more time one could make a neater package.

For most of us who do not have easy access to bracemakers, this simple thing can serve to maintain good functional position of the hand. We have used it to advantage also in the arthritic and the hemiplegic. As you can see, it can hold the thumb in a good functional position.

Dr. Miland E. Knapp (Minneapolis, Minnesota, closing): May I make a remark about this aluminum splint: We developed it by a series of improvements on previous devices, trying to keep them from breaking, and so on, and also trying to get something which could be opened so as to grasp objects. Most of the plastic and metal and leather opponens splints are not so flexible as to allow opening of the grasp: this interferes a great deal with their function.

The thing that I felt indicated the usefulness of this piece of apparatus to the greatest degree was that when one went around and saw the patients, they had them on. When you would say, "How is your opponens splint?" instead of taking it out of a drawer they would just hold up their hand. That meant they were useful and comfortable, and the patients really were using them. Whenever we would ask about the old splints we usually would have to go to the bedside table and take them out of the drawer.

MEDICAL NEWS

Members are invited to send to this office items of news of general interest, for example, those relating to society activities, new hospitals, education, etc. Programs should be received at least three weeks before the date of meeting.

Federation of American Societies for Experimental Biology

At the Statler, New Yorker, McAlpin and Governor Clinton hotels in New York, April 14-18, a meeting of medical research scientists will be held. At this session approximately 5,000 physiologists, biochemists, pharmacologists, pathologists, immunologists and nutritionists will take stock of a year's research. The latest developments in medical science will be reported in approximately 1,600 scientific papers.

The meeting will be a joint conclave of scientific groups representing the basic medical sciences — meeting together under the banner of the Federation of American Societies for Experimental Biology. Most of the Nobel Prize winners in medical science are members of the Federation.

Pennsylvania Academy Meeting

At the March 22nd meeting of the Pennsylvania Academy of Physical Medicine and Rehabilitation, symposiums on arthritis and peripheral vascular disease were presented. The following papers were given: "Treatment of Rheumatic Pain," by Dr. Peter J. Warter; "Orthopedic Management of Arthritis," by Dr. Frederick J. Stiepan. Dr. **Richard T. Smith** discussed the foregoing subjects. "Evaluation of Treatment in Arteriosclerotic Peripheral Vascular Disease,'" by Dr. **Bror Troedsson,** and "Surgery in the Management of Peripheral Vascular Disease," by Dr. Samuel T. Lloyd were discussed by Dr. **Albert A. Martucci.**

Radioisotope Courses

The Oak Ridge Institute of Nuclear Studies is offering three additional courses in techniques of using radioisotopes in research this summer. Dates are: June 9-July 4; July 7-August 1, and August 11-September 5. Additional information can be obtained by writing to Ralph T. Overman, Chairman, Special Training Division, Oak Ridge Institute of Nuclear Studies, Oak Ridge, Tenn.

New York Society Meets

At the March meeting of the New York Society of Physical Medicine, the following topics were presented: "Physical Properties of Muscle," by Sergei Feitelberg, M. D., discussed by Alexander Sandow, Ph.D., and "Muscle Tester and Foot Exerciser," by William Bierman, M.D.

Kenny Foundation Scholarships

The Sister Elizabeth Kenny Foundation is making free scholarships in Kenny Therapist training available to a limited number of accredited schools of nursing throughout the country, it was announced at national headquarters of the polio Foundation in Minneapolis.

To be eligible, the applicant for the course must be a registered nurse or physical therapist, not over 40 years old. Qualified male nurses or physical therapists are accepted.

Tuition for all courses is paid by the Kenny Foundation. In addition, the Kenny Foundation provides adequate financial assistance on a monthly scholarship basis to permit a comfortable standard of living during training.

Those who wish to apply for the scholarships are invited to contact the Director of Training, Sister Elizabeth Kenny Foundation, 1800 Chicago Avenue, Minneapolis, Minnesota.

Personals

Dr. **A. B. C. Knudson,** Chief of Physical Medicine and Rehabilitation Division, Veterans Administration, recently toured the Kessler Institute, West Orange, N. J.

Howard A. Rusk, New York, N. Y., spoke on "Dynamic Therapeutics in Chronic Disease" at the Michigan Clinical Institute, held in Detroit on March 12-14.

Doctors **George G. Deaver** and **Charles S. Wise** are members of the 11-member Task Force on the Handicapped. After an eight month study, the Task Force filed its report with the Office of Defense Mobilization. The report contains findings of fact and recommendations for making better use of handicapped persons.

Professor Boehm-Munic

Communication has been received from Dr. L. Grober in which he writes: "My friend Professor Boehm-Munic had many friends in America. Perhaps his American friends will be interested in the news of his untimely death. We feel the field of physical medicine has lost one of its most prominent colleagues."

Grant Awarded to University of Wisconsin

The University of Wisconsin Medical School, Madison, has been awarded an $8,110 March of Dimes grant for the study of the effect of certain chemicals on susceptibility to experimental poliomyelitis.

Latin-American Congress of Physical Medicine

The American Congress of Physical Medicine was well represented at the recent meeting in Panama City. The following members participated:

Cassius Lopez de Victoria — Executive Director of Latin-American Congress.

Max K. Newman — "Clinical Applications of Ultra Sound—Observations on Unselected Cases with Musculoskeletal Disorders."

Ferdinand F. Schwartz — "Physical Medicine and Rehabilitation in Orthopedic Problems and Treatment of Cerebral Palsy."

Glenn E. Drewyer — "Physical Procedures in Rheumatic Arthritis."

O. L. Huddleston— "The Use of Physical Medicine in the Treatment of Anterior Poliomyelitis at the Kabat-Kaiser Institute."

Bills Introduced

Arizona — H.10 — proposes creation of a board of physical therapy examiners and defines physical therapy as treatment of bodily or mental conditions by use of physical, chemical, or other properties of heat, light, water, or electricity, or by massage and active and passive exercise, prescribed by a licensed physician, but does not include the use of roentgen rays and radium for diagnostic and therapeutic purposes or the use of electricity for surgical purposes, including cauterization.

South Carolina — H.1760 — same as above.

New York — A. 2629. — To amend the education law, proposes to authorize school districts to furnish special services, including physiotherapy, occupational therapy, and so forth, to children with cerebral palsy.

Bureau for Handicapped Children

The Health Department of New York City recently announced the creation of a bureau for handicapped children, with Dr. Helen Wallace as Director. More adequate case finding procedures will be developed, as well as the stimulation of research to prevent crippling conditions and a community plan which will enable families in need of this service to find it among the groups helping the handicapped.

National Foundation Awards

A total of $1,775,393 has been awarded to hospitals, medical schools and research institutions by the National Foundation for Infantile Paralysis. Studies will be made on poliomyelitis.

Report on Chronic Disease Available

The National Conference on Chronic Disease has issued its first report entitled, Steps Toward Prevention of Chronic Disease, in booklet form. It is available at a cost of fifty cents. Write to Health Publications Institute, 216 N. Dawson St., Raleigh, North Carolina.

Newly Registered Therapists

February 4, 1952

Asklund, Shirley Carolyn, 8210 Justine St., Chicago 20, Ill.

Banko, Minnie-Dorris, 2610 First Pl., Lubbock, Texas.

Bargion, Pauline Flora, 922 N. Third St., Ishpeming, Mich.

Basford, Phyllis Betty, 1800 Chicago Ave., Minneapolis, Minn.

Bass, Bessie Ray, King St., Halifax, N. C.

Brittle, John Rudolph, 1720 Elmsmere Ave., Richmond, Va.

Buddell, Wilford, 142 W. Windsor, Reading, Pa.

Campbell, Elizabeth Ursula, 31 Claymoss Rd., Brighton, Mass.

Campbell, Mary Elizabeth, 517 Granite Ave., Richmond, Va.

Coryea, Nelson Henry, 1610 Park Ave., Richmond 20, Va.

Coughenour, Sara Jean, 414 Morgantown St., Uniontown, Pa.

Crawford, Regina Baxter, 104 Grove St., Farmville, Va.

Dinerman, Jack, 220 W. Oglethorpe Ave., Savannah, Ga.

Dooley, Marion May, Harrisville, N. Y.

Edwards, Betty Jane, 3326 W. Grace St., Richmond 21, Va.

Farmere, Fred Ansley, 700 W. 4th St., Little Rock, Ark.

Felix, Helen Marjorie, 495 Cooper Ave., Johnstown, Pa.

Frazier, Madell, 1508 Hawthorne, Baytown, Texas.

Gruelle, Everett Leslie, 3024 N. Hegry Circle, Cincinnati 38, Ohio.

Hall, John Luther, 17 Lozier Place, Plattsburg, N. Y.

Hyatt, Clarence John, 2011 H. St., Sparks, Nevada.

Hyde, Robert H., R. D. No. 1, Greenville, Pa.

Kamholtz, Donald Edward, 165 S. Main St., Salamanca, N. Y.

Kantzer, Charles W., 2021 New Jersey, Los Angeles, Cal.

Kline, Ivan Carstater, 83 Ivory St., Frewsburg, N. Y.

Knox, Effie, 1603 Arch St., Little Rock, Ark.

Lisle, Jamie Lou, Hanover, Va.

Logan, Gene Adams, % Mr. Woodrow Logan, 913 Pottowatomie, Leavenworth, Kans.

Love, Joseph Arthur, 186 Audubon Dr., Snyder, N. Y.

McNaughton, Penelope Jane, Copperhill, Tenn.

Magato, Richard S., 401 Euclid Ave., Versailles, Ohio.

Melvin, Lorraine Elizabeth, 101 Garfield Ave., Danbury, Conn.

Nelson, Charlene Mae, Box 316, Leesburg, Fla.

Park, Ann L., % Mr. Gregore Lieber, R. F. D., No. 4, Rome, N. Y.

Parker, Thomas Gaines, 4108 Glenbrook Ct., Houston 17, Texas.

Poli, Dominic, 178 Graham St., Biddeford, Me.

Popoff, Boris George, 1513 Moss St., Reading, Pa.
Poulson, James Harvey, Middle Ridge, Perry, Ohio.
Quinn, Alice Lenn, % Okolona Messenger, Okolona, Miss.
Rowan, Virginia Mary, R. F. D., No. 1, Apollo, Pa.
Snyder, Bruce Boots, R. F. D., No. 1, Fairbury, Nebr.
Spano, Gloria Hazel, 85 Allard Blvd., New Orleans, La.
Spivey, Marcus Elliott, Jr., 2611 Hanover Ave., Richmond, Va.
Swack, Myron Jerome, R. F. D. 3, West Salem, Ohio.
Swift, Bernard Wentworth, 343 Trafton Rd., Springfield 8, Mass.
Szumski, Alfred John, *26 Raritan Ave., South* River, N. J.
Thomas, Harry, Jr., 1509 Bedford Ave., Lynchburg, Va.
Urban, Mary Margaret, 426 W. South St., Mahanoy City, Pa.
Ushela, Clarence Walter, 21 N. Emerick St., Shenandoah, Pa.
Wells, Margaret, 7984 Miller Rd., Miami 43, Fla.
Wharam, William Herbert, 45 Elmview Pl., Buffalo, N. Y.
Wood, Shirley Moorehead, 12 Glen St., Melrose, Mass.
Zehmer, Evangeline Young, 1201 E. 49th St., Richmond, Va.

February 5, 1952

Baldwin, Ella May, 8 Pender St., Hudson Falls, N. Y.
Baskin, Norton, 3477 Beechwood Blvd., Pittsburgh 17, Pa.
Bellas, Mary, 603 Charles St., Wellsburg, W. Va.
Bennett, Mary Edith, 855 "E" St., Salem, Ore.
Bergstrom, Doris Arlene, Bock, Minn.
Brown, Dorothy Hale, Ellerson, Va.
Brown, Marie Anne, 7439 Buckingham Dr., St. Louis 5, Mo.
Brunsell, Gerald Harley, 155½ N. Fourth St., Evansville, Wis.
Cali, Sarah Dorothy Ann, 597 Clinton Ave., S., Rochester 20, N. Y.
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Cutler, Martha Perry Adams, 45 Iuka Ave., Akron 10, Ohio.
Dent, Gloria D., 1305 Prince, Beaufort, S. C.
DePorter, Evone, R. R. 1, Whitewater, Wis.
Diaz-Buso, Yolanda, 253 San Jorge St., Santurce, P. R.
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Nicol, Robert Harold, 745 S. 5th West, Missoula, Mont.
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Smith, Anne, 1195 Kirkham, Glendale 22, Mo.
Stanton, Joseph S., R. D. No. 1, Box 311, Finleyville, Pa.
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February 7, 1952

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Bell, Ralph Emerson, Jr., 4651 N. 24th St., Phoenix, Ariz.
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Bower, Neil, 121 S. Washington Ave., Dunellen, N. J.
Cabrera, Nereida, 1120 Humacao St., Rio Piedras, P. R.
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Davies, Robert Richard, 2817 W. 11th Ave., Denver 4, Colo.
Davison, Carter Nichols, 238 Ruby St., Lancaster, Pa.
Evans, Vilma Inez, 115 Hamilton Pl., New York 31, N. Y.
Fuoco, Frank John, 243 Wood St., Bristol, Pa.
Galie, E. Joseph, 453 Jacksonville Rd., Hatboro, Pa.
Gawthrop, Barbara Miller, 231 Lafayette St., Kennett Square, Pa.
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Stearns, Mary Frances, Locust Lane, North Conway, N. H.

Stermer, Gordon Ernest, 133 Cutler Ave., Corning, N. Y.

Valy, Esther Gisela, 56 Campus Dr., E., Snyder, Buffalo 21, N. Y.

Wade, Edna Elaine, 7 Steele Ave., Brownsville, Pa.

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Wiechmann, August Gerhard, % Kate Jacobs, Pleasant Grove, Utah.

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Fiksdal, Ramona Isobel, 4029 S. 8th St., Arlington, Va.

Ford, Barbara Elaine, 435 N. Maple St., Lancaster, Ohio.

Parker, Betty Joan, 403 S. Second St., Clarksville, Tenn.

Reinbold, Carolyn, 216 S. 14th St., Herrin, Ill.

Riviere, Nancy Joan, 3811 Segovia St., Coral Gables, Fla.

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Cook, Vernon Elton, 331 S. State St., Los Angeles, Cal.

Edberg, Elwin Leonard, 8 Benson St., Jamestown, N. Y.

Gal, Troyan Charles, 41322 6 Mile Rd., Northville, Mich.

Heisel, Erna Alma, 120 N. Oak St., Hinsdale, Ill.

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Price, Theresa Marie, Arriba, Colo.

Price, Virgil I., Arriba, Colo.

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Smith, Maxine Louise, 1145 Myrtle St., Pontiac, Mich.

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March 6, 1952

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ARCHIVES of PHYSICAL MEDICINE
OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL MEDICINE

.·. EDITORIAL .·.

PHYSICAL MEDICINE AND ATHLETIC INJURIES

In this age of high-powered athletic competition both on an amateur, semi-professional, and professional level, the management of athletic injuries is a subject of considerable importance. It goes without saying that prevention of injury is the keynote of progress. The publications of Thorndike[1] have shown that in a contact sport such as football where the player is subjected to repeated severe mechanical stresses and strains, the incidence of injury may be substantially reduced. For example, during the 5-year period from the fall of 1932 to the spring of 1937, the incidence of knee sprains was 204, whereas from 1937 to 1942 it fell from 204 to 161 and to 58 during the next 5-year period.[2]

The measures necessary include first of all a careful history of possible previous injury, particularly in school athletics. There should be a detailed examination to detect any residual weakness which may lead to recurrences. Proper conditioning prior to actual competitive test is, of course, essential. Successful coaches have learned the importance of this and take a real personal interest in this phase of the development of a team. Proper equipment for the protection of players is an item of universally recognized value.

Even more important, however, is medical supervision of athletes in contact sports to detect minor injuries before they become serious and to insure prompt and adequate therapy of any serious injury. Again in the field of prevention, conditioning exercises for the development of the musculature of the knee and ankle joint is of especial importance, and also the use of protective adhesive strapping to guard against recurrent injuries. This has been well demonstrated by Thorndike in his study of injuries in the Harvard football team. The reduction of the occurrence of ankle and knee injuries is particularly impressive. Over a 10-year period the former dropped from 110 to 40 and the latter from 161 to 61. In another analysis he has reported that in 1937 the average number of exposures without injury, by which is meant one afternoon period of practice or play for each man in the sport, was 33.1, whereas in 1947 it had increased to 53.37. Considering sports by seasons, he found that the highest incidence was in fall sports with a figure of 1,453 as compared with 398 for spring, and 310 for winter.[3] This is due to the higher incidence of injury in body contact sports like football and soccer, although the fall sports were the most highly supervised and organized. In spite of these advances, as everyone knows, athletic injuries are all too common, and their treatment is a matter of considerable importance from many obvious viewpoints including the financial one.

In a recent publication Thorndike has again reviewed the subject of trauma of athletics.[4] In this he has emphasized that the three major body regions most commonly injured in competitive sports are the shoulder, knee and ankle. He also pointed out the experience of several authors that good coaching and medical supervision has led to very favorable experience in the morbidity of injury from football in secondary schools, and no fatalities in 31 years' experience in the High School League in the City of Boston.[5]

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[1] Thorndike, Augustus: Athletic Injuries, Prevention, Diagnosis and Treatment, Editions 2 and 3 Philadelphia, Lea & Febiger, 1942 and 1948.

[2] Ibid, ed. 3, p. 76.

[3] Ibid., ed. 3, p. 62.

[4] Thorndike, Augustus. The Trauma of Athletics, New England J. Med. 246:335 (Feb 28) 1952.

Thorndike's discussion of new developments in the therapy of trauma in the past decade is devoted entirely to advances in physical medicine and rehabilitation. He has mentioned experimental studies on the physiologic effects of new microwave diathermy and stressed its potential dangers and also briefed his readers on the current status of ultrasonics as a physical therapeutic possibility. He has placed especial emphasis on remedial exercise and in particular the technique of strengthening exercises known as progressive resistance exercises which he endorses. Gallagher has also impressively shown the value of progressive resistance exercises in the treatment of athletic injuries of adolescents.[6] Physiologic studies of reaction time have shown that in spite of increasing the power of muscles to a marked degree including hypertrophy, such exercise did not slow up the reaction time as so frequently claimed by coaches and trainers.[7]

This brief review of some current literature suggests that athletic injuries are very frequently encountered and their treatment with procedures in physical medicine is considered of utmost importance. It accordingly seems strange that physicians trained in the specialty of physical medicine have contributed so little to the medical literature on this subject, have not been generally accepted as valuable consultants, and further that the personnel usually employed in actually applying physical therapeutic procedures are not educated in accepted schools of physical therapy in order to understand the pathology of trauma and the physiologic effects of the physical agents employed. This situation has left the door open for the use of a variety of physcial agents for largely psychological effects, particularly when the agent is electrical. It is also of interest to note the great popularity of massage which outranks all other physical procedures.[8] We note also that the term "massage" is sometimes used to actually cover most of the different procedures of physical medicine and it is given credit for recovery of athletes particularly by sports commentators. There is no gainsaying the psychological effect of the laying on of hands, including the professional athlete as the patient, but surely one familiar with modern development of physical medicine would not place it first among the effective physical therapeutic procedures in the treatment of athletic trauma.

All this leads to the conclusion that the physiatrist and the trained physical therapist should have considerable to offer in the field of athletic injuries. The physiatrist should be able to contribute in the diagnosis of neuromuscular injuries through his detailed knowledge of functional muscle tests, and by quantitative analysis of electrical reactions. He is also trained to prescribe optimum methods of restoring neuromuscular function through the use of specific prescriptions for physical medicine. It also seems logical to expect that a well trained physical therapist and graduate of an approved school, particularly men who have previously worked in physical education, should make ideal therapists who could safely and efficiently handle the treatment of injured athletes. The suggestion is made that those physiatrists who do have an opportunity to study the effects of modern physical medicine for treat-

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5. Burnett, J. H.: Football Can Be Safe, J. Am. Assn. for Health Phys. Ed. and Recreation 22: 14, 1951.

6. Gallagher, J. Roswell: Adolescents. Chapter 10, pp. 206-237, in Progressive Resistance Exercise: Technique and Medical Applications, by DeLorme and Watkins. Appleton-Century-Crofts, Inc., New York, 1951.

7. DeLorme, T. L.; Ferris, B. G., and Gallagher, J. R.: Effect of Progressive Resistance Exercise on Muscle Contraction Time, Arch. Phys. Med. 28:86 (Feb.) 1952.

8. Thorndike, Augustus: Athletic Injuries: Prevention, Diagnosis and Treatment, ed. 3, p. 226. Philadelphia, Lea & Febiger, 1948.

ment of athletic injuries contribute more widely to the medical literature on this subject so that the important role of physical medicine in the treatment of athletic injuries may be more widely accepted.

ANNALS OF PHYSICAL MEDICINE

The ARCHIVES OF PHYSICAL MEDICINE desires to extend to our colleagues in the British Association of Physical Medicine hearty congratulations on the appearance of its new official organ, the *Annals of Physical Medicine.*

This new and excellent journal is edited by Dr. Hugh Burt, assisted by an Editorial Board of eight outstanding physiatrists. The general format and quality of the articles appearing in the first issue indicate that this will be a valuable addition to the literature of our field. The new *Annals of Physical Medicine* will be published quarterly by Headley Brothers, Limited, 109 Kingsway, London, W. C. 2, England. Annual subscription in the United States will be $3.00 and it is urged that physicians interested in physical medicine support this new journal by subscribing to it. The fact that it will be the official organ of the British Association of Physical Medicine, that an outstanding physician like Dr. Hugh Burt is the Editor, and that an excellent Editorial Board will guide its destinies, indicates that this journal will have a promising future which will merit the support of all physicians interested in physical medicine throughout the world. We desire to extend our felicitations to our colleagues in the British Association and to wish them every success with their new journalistic adventure.

BOOK REVIEWS

THE CURE FOR RHEUMATOID ARTHRITIS AND RELATED CONDITIONS (Osteoarthritis, Bursitis, Frozen Shoulder, Etc.) BY PHYSICAL MEDICINE. A Result of Thirty Years' Study. (Original Investigations.) By *Joseph Echtman,* M.D., Formerly in Charge Clinic of Physical Medicine, Mount Sinai Hospital, Stuyvesant Polyclinic Hospital; Beth David Hospital; Physician and Lecturer in Physical Medicine, New York Medical College and Flower Fifth Avenue and Metropolitan Hospitals; Physician, Cardiac Clinic, Mount Sinai Hospital, etc. Member American Congress of Physical Medicine, New York Physical Medicine Association, New York Heart Association, American Rheumatism Association, World Medical Association, New York County Medical Association, etc. Cloth. Price, $6.00. Pp. 251, with illustrations. Herald Square Press, Inc., 333 Spring St., New York 13.

Books of this type are usually ignored entirely and not honored with any review, however, because the title includes the words "Physical Medicine," this review is presented for the record.

On one of the preliminary pages this statement is made "The physical therapy methods described in this volume are entirely different from the methods discussed in physical therapy literature or employed in any physical therapy or arthritic clinic. These methods are original, being the result of the author's studies, investigations, observations, trial and error, and wide experience for over thirty years. They offer definite results, and are painless and safe." Then on the following introductory pages, a full page illustration is devoted to three pieces of apparatus with this title—"a long wave (conventional) diathermy, an ultra violet apparatus, and a galvanic sinusoidal (Morse wave) apparatus. They are the only three apparatus that are necessary for the treatment of all the conditions discussed in this volume." How this statement would justify the first statement is obscure.

Chapter I opens with a page devoted to classification. The first is the standard classification followed by another which list six classes of arthritis, namely—"thermal, ultraviolet, salicylate, lithium, magnesium sulfate and iodine."

Chapter II begins with the "Curability of rheumatoid arthritis" in which this statement is made "physical medicine at present is the only method to produce lasting results or a cure of this disease without causing injury." Then a comparison is made between those accepted methods used today and those which the book proposes. It is stated that "heat, especially diathermy, and also the triad (baking, massage, and exercises) not only have no curative effect and are of no appreciable therapeutic value in rheumatoid arthritis, but are directly harmful"! Then a few paragraphs on the "brutal and harmful" effects of exercises.

The chapter on ionization contains many statements that are certainly questionable and require more confirmation, for example "salicylate ionization should be preferred to all other drugs employed in the ionization methods"; "fibrinogen is the nucleus of the formation of pathologic tissue"; "in gouty arthritis lithium ionization seems to be specific"; and the justification for magnesium sulfate as the "local anesthetic effect on peripheral sensory nerves."

Chapter VII is on the effect of ultraviolet radiation and statements such as these appear — "it (ultraviolet radiation) causes an increase in body resistance by rendering toxins in the body inert"; "death lurks in the erythema when given to the entire body and above all it is generally useless therapeutically"; and considerable discussion about the "miraculous results" with a suberythema technique. The ultraviolet radiation is given "at every *seance*" (italics supplied by the reviewer). According to Webster's new International Dictionary one of the definitions of seance is "a treatment as by electricity or massage." The book refers to massage as being "useless."

Chapter XII covers ankylosing spondylitis and its treatment. A foot note on the first page says this — "The word 'cure' in rheumatoid arthritis is used in this book only in discussing the treatment of the joints of the extremities but not when discussing treatment of rheumatoid spondylitis where the word 'treatment' is used. For the former I have developed methods offering a cure or good results that last for many years, while in the case of the latter no one has as yet achieved methods offering a cure or lasting results." The opening paragraph of the chapter begins "I employed a hand baker, iodo-salicylic ointment and an ultraviolet lamp successfully . . . over a quarter of a century ago, in the treatment of a woman, aged 21, suffering from early rheumatoid (ankylosing) spondylitis . . . after six months treatment, the patient fully recovered and still feels well." If these simple methods produce a remission of "over a quarter a century" when is the word "cure" to be applied? In spite of the success of this case further description of the treatment for spondylitis suggests "long wave (conventional) diathermy followed by my combined ionization and interrupted surging sine wave method," usually referred to as the "IISSWM" method. Although the chapter is labeled "spondylitis," a few remarks are given about gout and practically an entire page on diet in rheumatoid arthritis.

The next chapter considered rheumatic diseases in children. For rheumatic fever ionization with sodium salicylate is recommended during the acute stage and interrupted surging sine wave current "to prevent contractions or cure them if present." The statement is found that "the results obtained from the salicylates and digitalis in the clinic were poor." The diagnosis of rheumatic fever in a child in which permanent joint damages occurs might seriously be questioned. The case of a girl, age 10, who received 200 exposures of ultraviolet radiation and of an adult who received radiation three times a week for two years is cited. The heading of this section of the book is "Pediatric Physical Medicine" and the chapter heading is "Rheumatic Diseases in Children"; however, a lengthy case report is inserted of an adult male with "symptoms of intestinal tuberculosis" who had had surgery for ischio-rectal abscess. This is a further example of the very poor organization of the book.

Part II is on Osteoarthritis. No further comment need be made than this quotation — "apparatus needed to cure osteoarthritis: only two apparatus are necessary: (1) galvanic (sinusoidal) and (2) long wave diathermy."

Part III is labeled "Related Conditions." This begins with bursitis. Excessive use of the personal pronoun "I" and excessive depreciation of all methods except those advocated in the text are undesirable. Several case reports are included which in most of the reports merely mentions the lack of success with other methods and how the techniques outlined in the book were able to produce a "cure."

The next chapter is entitled traumatic arthritis which is covered on one page and is followed by remarks about injured semi-lunar cartilages, joint mice and "useful points in the treatment of diseased joints." For joint mice the treatment is summed up as follows "I have observed that if the offending body is a piece of broken off cartilage, long wave diathermy cures the condition."

Short chapters follow on Heberden's Nodes, Acromioclavicular osteoarthritis and the last one of three pages considers myositis, myalgia and dermatalgia. For the last condition Oudin effluve is suggested and the book ends with this statement from a patient treated with the Oudin effluve — "I have you to thank that I am living today."

If the quotations already given in this review are not sufficient evidence of the ideas the book presents the following ones should be added which are only a few that might be offered: — "the formula of vitamin B resembles that of insulin" then the formula of vitamin B and insulin are given followed by "note that the "S" atom is present in each molecule"; on the use of the Kromayer lamp — "it is usually employed with pressure for the dehematization of the skin"; on the use of ultraviolet radiation — "in cases of mitral insufficiency. Here the murmur usually disappears entirely"; on heat therapy in osteoarthritis which is "indispensable in the chronic stage to cause absorption of the spurs (osteophytes)"; spurs in osteoarthritis "are the only cause of disability"; and "as soon as they are absorbed, a lasting cure is obtained";

"experience has convinced me that long wave diathermy is specific in causing resorption of calcium in joints, capsules of joints, tendons, etc."; "the calcium content of the broken off pieces of cartilage is dissolved by the thermal energy of the long wave diathermy. It becomes soft after a number of treatments, flattens out like a soft piece of wax and causes no more trouble to the patient"; "the ionization with magnesium sulfate causes the tissue to lose alkali, resulting in the relief of pain"; "current (long wave diathermy) causes proportionately more heat in bone and calcium deposits than in muscle and circulating blood"; "he developed a severe cardiac palpitation (over 300 beats per minute) induced by the energy of the short wave diathermy"; on Heberden's Nodes treatment — "ionization with lithium salts followed by the interrupted surging sine wave current is the best treatment and the only one which will actually benefit this disease"; on neuralgic pain — "because of impaired circulation the tissues are not properly nourished and the pain is merely a cry of the tissues for nourishment." And many, many more statements could be cited that need confirmation.

It is difficult to conceive of a more inaccurate, more confused and poorly organized book than this one. It is most unfortunate that the words "Physical Medicine" are included in the title of the book. An injustice is done to the specialty of physical medicine by the implication that physical medicine is able to cure rheumatoid arthritis but more important than that, is the advocacy of physical therapy for reasons and in the manner mentioned in this book. It is hoped that this long review may counteract any inference that methods reported in the book in treating the rheumatic diseases are those usually accepted as physical medicine today.

SPEECH HABILITATION IN CEREBRAL PALSY. By *Marion T. Cass*, Ph.D., Instructor in Speech Science, Columbia University College of Physicians and Surgeons, New York City. Cloth. Price, $3.00. Pp. 212. Columbia University Press, New York; also published by Geoffrey Cumberlege, Oxford University Press, London, Toronto and Bombay.

The author, who has spent a number of years in remedial speech therapy for handicapped children, is eminently well qualified to write a book setting forth methods utilized in speech training for children with cerebral palsy. At present in addition to her teaching responsibilities she is associated with Dr. Winthrop Morgan Phelps of Baltimore who has written a foreword for this book.

She begins by quoting current concepts of the etiology of cerebral palsy, including the various types of anoxia, the sensitivity of the fetus to irradiation, the role of the Rh factor, birth trauma, and use of obstetrical drugs. In a chapter entitled "Motor Reeducational Speech Therapy" she outlines the approach that is used in speech training of the child with cerebral palsy, which actually is quite similar in principle to that used in motor reeducation of the child's other muscles. The methodology of such therapy is discussed clearly and logically, in commendable detail. Each sound that the child must master is taken up in the order of its difficulty and a series of exercises and suggestions are made, including rhymes that utilize the sounds discussed. A useful bibliography is included.

There are a few minor aspects about the book with which some exception might be taken. For example, the author defines cerebral palsy as a "disturbance of muscle function which has its origin in the brain." This would appear to include such non-related conditions as cerebro-vascular accidents with hemiplegia, paralysis agitans, which indeed she calls an "acquired cerebral palsy," and even hysterical paralysis. Also, the reviewer would question the advisability of including a twelve-page summary of the embryologic development and function of the central nervous system which the author quotes from Arey's "Developmental Anatomy." It is unlikely that this section will be easily understood by the average reader.

Despite these minor faults, this book fills an important need and should be read and reread by everyone concerned in the treatment of the child with cerebral palsy.

THE PORPHYRINS AND THEIR RELATION TO DISEASE. Porphyria. By *Cecil James Watson* and *Evrrel Arthur Larson*. Chapter IX-A, Oxford Loose-Leaf Medicine. Paper. Illustrated. Pp. 228 (1) — 228 (59). Vol. IV. 251. Oxford University Press, Inc., 114 Fifth Avenue, New York 11.

Of the new sections in Christian's Oxford Medicine recently received, Chapter IX-A is of particular interest to physiatrists. The subject is The Porphyrins and Their Relation to Disease: Porphyria, by C. J. Watson and E. A. Larson. This is an excellent review of this unusual disease. Photosensitivity to light, fluorescence in near ultraviolet and neurological phenomena concern those in the practice of physical medicine and rehabilitation.

PHYSICAL MEDICINE ABSTRACTS

Importance of Physical Medicine and Rehabilitation for the Industrially Injured. Gordon M. Martin.

J. Michigan M. Soc. 50:730 (July) 1951.

Problems of physical restoration and rehabilitation of individuals injured or handicapped by industrial or occupational accidents should concern everyone. The employee always has either a conscious or an unconscious dread of an occupational accident, and fears its effect on his earning capacity and on the economic security of his family. During the past twenty years, industries and employers have continued to assume greater responsibility for the health of the workers. As a result, rapid strides have been made in prevention of occupational accidents. Also, more comprehensive liability insurance programs have been developed to provide compensation, as well as funds for necessary medical and surgical care. However, facilities for physical medicine, which are essential for final physical restoration and rehabilitation, have been most inadequate. In the report on America's health, a group of authorities on these problems declared: "Physical restoration is the largest missing link in the treatment of the industrially injured." The first-aid treatment now available for the victim of the industrial accident is good. Medical and surgical care as it is provided by the patients' physician or by physicians retained by the employer, and by consulting specialists, is excellent. However, adequate facilities for physical medicine, which provides for physical restoration and rehabilitation during and following definitive medical care, do not exist in most places. Physical therapy, the cornerstone of physical medicine, consists of the use of physical agents including therapeutic exercise, heat, massage and water and electricity for treatment. A large percentage of the most common occupational injuries result in disabilities that deserve thorough well-supervised physical therapy to insure most rapid and complete recovery of maximal function. A survey of the types of industrial injuries indicates that the majority of the disabilities that delay recovery and return to work are the result of injuries that leave residual stiffness of joints, muscular weakness, and poor coordination. These residual effects ordinarily can be minimized by physical therapy and occupational therapy. It would seem that with some increase in medical expenses in order to provide physical medicine and rehabilitation services, the period of disability and compensation can be shortened markedly and the degree of recovery of function increased. Thus with less money needed for compensation, insurance rates could be reduced.

The concept of what constitutes an adequate service in physical medicine and rehabilitation for the industrially injured patient has changed considerably from the concepts of physical therapy which existed ten to twenty years ago. No longer can one consider diathermy or a whirlpool bath, used for twenty to thirty minutes three times weekly, to constitute even basic physical therapy. The aim of the physical medicine and rehabilitation program is to hasten restoration of function of involved parts. Thus: (1) joints must be mobilized or their stiffness reduced; (2) muscular strength must be improved; (3) coordination, speed of movement and endurance must be augmented. In order to accomplish these things, treatment should be started as soon as possible following injury. Details of the treatment should be carefully prescribed by the physician and then should be carefully carried out by a staff of qualified therapists. Several hours daily should be devoted to the physical rehabilitation program of most patients.

The reasons why programs of physical medicine and rehabilitation have been slow in becoming available to the majority of industrially injured patients are these: (1) Owing to the recent evolution of the modern concept of this phase of medical care, many physicians have not had an opportunity to become thoroughly acquainted with the possibilities offered by such a program, to say nothing of becoming familiar with the techniques and procedures, so that they can guide and supervise the physical therapists and other supporting personnel. This deficiency is gradually being overcome, as training courses are being offered to physicians in postgraduate courses and at medical meetings. Also many medical students are taking courses designed to instruct them in such aspects of physical medicine and rehabilitation as can be applied in general practice as well as in many of the specialties.

(2) There is a shortage of qualified physical therapists, so that most departments of physical medicine are not sufficiently staffed. Because of the highly specialized training of the physical therapist, as well as the shortage of available personnel, the cost of hiring enough qualified persons is necessarily high. Therefore, many institutions which could use three to six therapists may be limited to the employment of only a single individual or none at all.

(3) Hospital staffs and hospital boards often fail to see the economic advisability of setting aside space, and of providing personnel for physical medicine and rehabilitation.

(4) The allotments for medical care for the industrially injured which are included in some

of the compensation and insurance plans may provide only limited or inadequate funds for physical medicine and rehabilitation.

(5) Education of the public in regard to the importance of physical medicine and rehabilitation for the treatment of the industrially injured is incomplete. It is hoped that in the relatively near future, the patient with an industrial injury, who now takes for granted the use of the roentgenograms in diagnosis of his injury, can likewise expect to have facilities for physical medicine and rehabilitation utilized for his convalescent care.

The Art of Medicine in the Management of Multiple Sclerosis. Alfred Gallinek.

New York State J. Med. 51:1930 (Aug.) 1951.

In consideration of the unpredictable course of multiple sclerosis, particularly in consideration of the possibility of remissions of very long duration, the diagnosis of multiple sclerosis, with its numerous implications, generally should not be revealed to the patient himself. Although there is no effective therapy and no rationale for such, psychologic common sense requires that the sufferer from multiple sclerosis should be "treated." Although no treatment has definitely been proved to be organically effective in this disease of unknown etiology, almost any treatment may be of great psychologic benefit. According to the classic concept, exercise should be avoided. Recently objections have been raised to this. Putnam even speaks of "vigorous exercise." Gallinek has been impressed by various incidents of abrupt terminations of remissions following immediately after vigorous exercise. Brickner has made similar observations. Gallinek feels that exercise should be avoided and that all efforts in the line of so-called rehabilitation should be guided by this principle. He also believes that remissions occur more frequently after prolonged episodes of rest rather than after periods when the patient tries to keep going. It goes without saying that emotional stress and excitement should be avoided as far as possible.

Fractures of the Upper End of the Humerus. John A. Powers.

South. Med. & Surg. 113:225 (July) 1951.

In considering fractures of the upper end of the humerus, the author has included those which occur at or above the insertion of the latissimus dorsi and the teres major. These fractures have logically been classified according to age. Humeral fractures assume their greatest importance when they occur in children. Injuries to the epiphyseal plate result in growth changes and positional deformities of the humeral head. In adults the treatment of complete fractures of the surgical neck is similar to that in children. However, fractures with adduction of the proximal fragment are about as frequent as those with abduction, the type depending on how the extremity is held when the patient falls. These are treated by immobilization with the arm at the side, as in a Velpeau bandage. In the older patient, where early ambulation and a functioning shoulder outweigh the advantages of an anatomical reduction, treatment is by necessity limited. The arm is placed in a sling or a Velpeau dressing for a minimal period, usually fourteen to twenty-one days, and then active shoulder motion is instituted. Probably no group of fractures demands a more vigorous program of physical therapy than those of the proximal humerus, particularly in the aged. The desire to prevent soft tissue contractures with resultant limitation of motion should remain paramount in the mind of the surgeon. To this end he might sacrifice accurate x-ray repositioning and the freedom from pain that goes with prolonged immobilization.

Physical Medicine in General Practice. Ferdinand F. Schwartz.

J. M. A. Alabama 21:37 (Aug.) 1951.

The employment of physical medicine for the treatment of diseases and injuries has become a very important adjunct in the daily practice of medicine. The most commonly used physical agents in general practice are heat, light, water, ultraviolet rays and exercises. Heat may be applied locally by lamps, short wave, electric pads, moist compresses, paraffin and water. Regardless of which modality is employed, certain basic principles should be observed; namely, the condition of the patient, the pathology involved, age, temperature, distance, time element and sensitivity. Heat must be applied carefully in peripheral vascular diseases and diabetes where the diseased blood vessels cannot take care of the increased circulation. Paraffin baths may be used for home treatments. Contrast baths are useful adjuncts in the management of arthritis at home. In office practice, heat may be employed through short wave diathermy. Care must be observed in spacing the electrodes. Since one cannot estimate the amount of heat to be tolerated by the patient with short wave, the patient should be observed constantly. It is better to give too little than to burn the patient. Ultraviolet rays are invisible and are known as chemical rays. They should never be prescribed carelessly for home use, in spite of the great pressure which is exerted by certain retail outlets. The minimal erythema dose should be ascertained in each individual case and then one-fourth of this amount is given as the initial dose of ultraviolet. The rheumatoid arthritis patient should have rest in order to avoid strain on the joints, and this should be on a non-sagging bed, with the joints in maximum extension. Since deformity takes place in flexion, the extensor muscle groups have to be developed, and exercises must be carefully and accurately prescribed. In addition, to carry the joints through the range of motions, muscle tensing exercises must be prescribed, such as the quadriceps setting exercise. All exercises are to be performed slowly and rhythmically, with complete relaxation in between the exercises. In the acute inflammatory stage, exercises should not be performed. It is a good policy to start the exercises about two times at one session, repeated every four hours if no pain develops; then gradually add one more daily. Breathing exercises should be a part of the regimen since they promote expansion and ventilation of the thoracic cavity. Detailed basic exercises for rheumatoid arthritis are given. These should be preceded by infra-red light for twenty minutes. After the exercises a gentle rhythmic massage is to be given, using mineral oil and alcohol over the parts. However, massage never should be given over joints. In osteoarthritis, particular attention should be paid to posture, occupation, and obesity, and the walking and sleeping habits of the patient. Heat, in the form of infra-red lamp, baker, or short wave in the office, will relax the muscles. The heat should be followed by massage and postural exercise, especially if the spine is involved. For hemiplegic patients gentle passive exercise is first given to the affected parts. Later active assistive and finally active exercises are to be engaged in. A pulley should be attached to the bed so that the patient may exercise the shoulders and pull himself up to a sitting position. Active exercise to the facial muscles should be instituted by having the patient blow, pucker the lips, close the eyes, open and close the mouth, grind the teeth, and protrude and then withdraw the tongue.

Cross Education: Ipsilateral and Contralateral Effects of Unimanual Training. F. A. Hellebrandt.

J. Applied Physiol. 4:136 (Aug.) 1951.

The bilateral influence of the unilateral practice of four standardized activities included in the MacQuarrie test of mechanical ability was studied on 50 normal young adult physical therapy trainees, 27 of whom were males. The test was first taken by the preferred and then by the nonpreferred hand. The group was then divided into two on the basis of equivalent hand dominance. Twenty-six subjects practiced once weekly with the left hand and 24 practiced with the right. The experiment extended over a period of 8 weeks at the termination of which right- and left-sided performance was again measured. Statistical analysis of the data supports the following conclusions: (1) Manual dexterity improves significantly with direct practice. (2) In general, the mechanical ability of the dominant limb improved more with direct practice than that of the contralateral extremity. (3) The unpracticed contralateral extremity also improves significantly in mechanical ability. (4) Dextral improvement due to cross education does not approach that achieved by direct practice. (5) The sinistral or non-preferred side may gain more as a result of practice by the contralateral limb than by ipsilateral direct practice but the differences are not significant. (6) The relative amount of motor learning taking place bilaterally appears to spread more nearly equally to the right and the left sides when training involves the less discrete pathways of the non-preferred limb. The mechanism of cross education is discussed. Analysis of the response of normal individuals to volitional exercise suggests that efferent patterns of discharge may take a bilateral course with the major flow going to the contralateral side, and a smaller but identical component traveling ipsilaterally. It is unknown whether this behavioral pattern has its origin in bilateral representation of the musculature in the motor cortex or because ideational motor planning involves a bilateral visualization of the body scheme as a whole.

Physical Medicine and Rehabilitation for Patients with Hemiplegia. L. R. Burnham.

J. Maine M. A. 42:173 (June) 1951.

The problem of rehabilitation of the hemiplegic is one of the increasingly persistent situations which the physiatrist may expect to encounter. The concept of treatment of this condition has markedly changed during the past decade. This change has been almost entirely along the lines of Physical Medicine Rehabilitation. The general aims of physical medicine rehabilitation treatment are to prevent deformity by maintaining flexibility in soft structures and joints of the affected parts; to aid the patient toward early active use of the paralyzed parts as soon as the functional physiologic processes permit and to give the patient psychic rehabilitation within limits of his cerebral injury. Treatment toward prevention of deformity and ultimate restoration of function should be instituted early. The joints, both those involved in the hemiplegia and those uninvolved, are to be put through the normal range of joint motion in turn, several times daily. In the uninvolved parts, this may be done actively and in the involved parts by passive motion preceded by heat. Spasticity may be reduced by means of hot packs or luminous heat. Spastic muscles should be stretched gently, smoothly, but firmly to overcome tending to contracture. Such stretching should be done after application of heat and light massage. Weak muscles may be exercised by electrical stimulation alternated with underwater exercises. As they increase in strength, resistive exercises may be instituted. The high resistance, low repetitive exercises as outlined by De Lorme will increase strength and as the result is obtained, high repetitive, low resistance, exercises may be used. These latter, while of little value in increasing strength, are of great value for developing endurance. After strength is developed, endurance may follow. Throughout the period of rehabilitation, patients must be made to realize that the outcome of treatment depends largely on themselves. Improvements may continue for months or even a year or more after the onset of the episode. Hemiplegia offers the physiatrist a challenge and will require therapy from all branches of his armamentarium to obtain the maximum results. With the estimate of fifty per cent of such cases being capable of self-care and possibly twenty per cent of these being capable of gainful employment, we have a definite goal to work for with this type of patient.

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ORIGINAL ARTICLES

Simplified Electrotherapy. Sedgwick Mead, M.D. 267
Discussed by Drs. Isadore Levin and Sedgwick Mead.

Some Effects of Cerebral Diathermy on Normal Adults. Emery K. Stoner, M.D., and Herbert Shapiro, Ph.D. 272
Discussed by Dr. Albert Martucci.

Precision of Elbow Ergography Under Varying Degrees of Muscular Fatigue. H. Harrison Clarke, Ed.D. 279
Discussed by Dr. Ben Boynton.

The Use of Cortisone in the Management of the Shoulder-Hand Syndrome. Nathan Sussman, M.D. 289

Ethyl Chloride Spray for Painful Muscle Spasm. Janet Travell, M.D. 291
Discussed by Drs. H. J. Behrend; William D. Paul, and Janet Travell.

•

Editorial 299

•

Medical News 301

•

Book Reviews 304

•

Physical Medicine Abstracts 306

•

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SIMPLIFIED ELECTROTHERAPY *

A New Stimulator for Home Treatment of Denervated Muscle

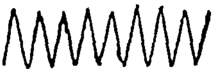
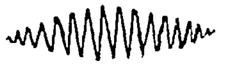
SEDGWICK MEAD, M.D.†

ST. LOUIS

Electrotherapy may be defined as the use of electric currents for their direct effects on tissues, and as ionic carriers. This definition excludes the various diathermies, which should be discussed under the term thermotherapy since they have not been proved to have other than thermal effects. No startling advances in electrotherapy have been made in the past 25 years; if anything, a welcome simplification has occurred, with the discard of certain doubtful procedures. The purpose of this paper is to point out some of the procedures in which electrotherapy has proved valuable and to discuss the basic considerations for a simple, yet effective and intense program of electrotherapy.

Passive Muscular Exercise

Passive muscular exercise forms the greater part of electrotherapy. It is often used where it can do no good, while certain fruitful opportunities are neglected. With equipment presently available it is relatively ineffective for increasing strength or endurance of muscle.

Electrical Stimulation of Normally Innervated Muscle. — The phrase "normally innervated muscle" refers to muscle with an intact nerve supply from the anterior horn cell peripheralward. Normal nerve-muscle units are excitable to many types of currents, including direct, sinusoidal, thyratron discharges, square wave pulses, and many others. Since single shocks are not considered effective, such currents are delivered in barrages, the triggering of which can be manual or automatic. The barrages can be rectilinear  or surged . The frequency should be high enough to obtain temporal summation but not so high as to enter the refractory period of nerve. There is a wide range of frequencies which are effective for producing a fused tetanic contraction. Many wave forms such as induced current (faradic) because of simplicity of instrumentation utilize the frequency of 60 cycles per second from the line voltage. In circuits where the duration and frequency are somewhat independent, a frequency of about 100 per second is an efficient figure, and is relatively pain-free.

Electrotherapy is a valuable adjunct to the technique of muscle reeducation in early pyramidal tract hemiplegia, in marked alienation (inhibition) from trauma, acute arthritis, local pain, surgical procedures, and to a limited extent in hysteria. In spastic hemiplegia one should preferentially treat the inhibited and overstretched upper limb extensors and lower limb flexors, and then only for a few weeks. The use of tetanizing currents to prevent thromboembolism, to control spontaneous movements of autonomous spinal cord segments, and to control pain in periarthritis and low back syndromes is at present controversial.

Dosage of most tetanizing currents is unfortunately in terms of arbi-

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* Read at the Twenty-Ninth Annual Meeting of the American Congress of Physical Medicine, Denver, Colorado, September 6, 1951.

† From the Division of Physical Medicine, Washington University School of Medicine.

trary dial units because of the expense and difficult instrumentation involved in getting true voltage and current readings. It is a mistake to record or pay too much attention to these dial readings. They vary greatly from patient to patient and in the same patient from day to day, because of skin impedance changes.

Electrical Stimulation of Denervated Muscle. — It is irrational to give passive exercise by electrical stimulation in a situation where return of voluntary control is impossible. In the denervation syndromes one should reserve enthusiastic therapy for nerve suture and similar situations where neurotization is confidently expected. It has been well established in experimental animals that daily stimulation of denervated muscle retards atrophy and leaves the muscle in better condition for reneurotization if reneurotization is possible.[1] Pollock, et al.[2] state that such stimulation is effective in the rat but not in the cat. No conclusive data on human beings are available.

The choice of currents in treatment of denervated muscle is restricted. Direct (galvanic) and 25 to 30 cycle sinusoidal currents are best known. Intolerance of the patient to pain produced by physiologically adequate amounts of current seriously limits their use.

Diagnostic Criteria for Muscle Denervation

Electrodiagnosis is a valuable adjunct to other clinical tests and criteria used in differential diagnosis. Some of these tests include electromyography, sweat tests, and skin impedance tests. In the presence of paralysis of skeletal muscle it is of importance to know whether such paralysis is central or peripheral, organic or functional.

One of the bases for differentiating between central and peripheral paralysis is the determination of excitability characteristics of the neuromuscular unit by artificial stimulation with electric current. The response of skeletal muscle which has lost its nerve supply by the process known as Wallerian degeneration is both qualitatively and quantitatively different from the response of the intact neuromuscular unit. Two types of current are usually chosen to bring out these differences: direct* (obsolescent term, galvanic) and tetanizing† (obsolescent term, faradic). The use of electric currents

TABLE

Type of Current	Normal (Nerve)	Denervated (Muscle)
Direct* Current		
Type of Response	Single sharp twitch at on and sometimes at off	Sluggish contraction, repetitive at high intensities
Motor Point	Present	Absent
Polar Formula	Cathodal threshold usually lower than at anode	Variable; usually equal
Threshold (Rheobase)	————	Lower than normal until reinnervation begins; then much higher
Tetanizing† Current		
Type of Response	Tetanus (response normal in hysteria and upper motor neurone lesions)	No response or only at extreme intensities

* Unidirectional current pulses of 50 milliseconds duration or longer.

† A barrage of discrete impulses, electronic or induced, of about 1 millisecond or less in duration. There are theoretical objections to the name tetanizing current, since brevity of the impulse, not its repetition is the essential feature.

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1. (a) Hines, H. M.; Thomson, J. D., and Lazere, B.: Physiologic Basis for Treatment of Paralyzed Muscle, Arch. Phys. Ther. 24:69 (Feb.) 1943. (b) Fischer, E.: The Effect of Faradic and Galvanic Stimulation Upon the Course of Atrophy in Denervated Skeletal Muscles, Am. J. Physiol. 127:605 (Nov.) 1939. (c) Kosman, A. J.; Osborne, S. L., and Ivy, A. C.: The Effect of Electrical Stimulation Upon the Course of Atrophy and Recovery of the Gastrocnemius of the Rat, Am. J. Physiol. 145:447 (Feb.) 1946.

2. Pollock, L. J.; Arieff, A. J.; Sherman, I. C.; Schiller, M.; Tigay, E.; Hiller, F.; Liebert, E., and Yacorzynski, G. K.: Electrotherapy in Experimentally Produced Lesions of Peripheral Nerves, Arch. Phys. Med. 32:377 (June) 1951.

provides the basis for Erb's classical Reaction of Degeneration (RD), 1883.

In carrying out excitability tests on skeletal muscle, one should not fail to test a normal homologous muscle. Excitability changes are not complete until about 14 days after injury to the anterior horn cell or nerve.

Much experimental work has been carried out in an effort to devise better tests to determine differential excitability of normal and denervated muscle. Among these tests are chronaxie, strength-duration and strength-frequency curves, galvanic tetanus ratios, and accommodation constants. None of these tests has gained sufficiently wide acceptance to replace the older and simpler Erb's test.

Choice of Diagnostic and Therapeutic Instruments

Manufacturing trends have taken two opposite directions: simplified equipment with a limited choice of diagnostic and treatment wave forms, and multi-choice consoles with a lavish display of possible currents and modifications. It is impossible to defend the selection of the second type of large and expensive instrument from any standpoint except research. Such devices are merely confusing to the average physician and therapist.

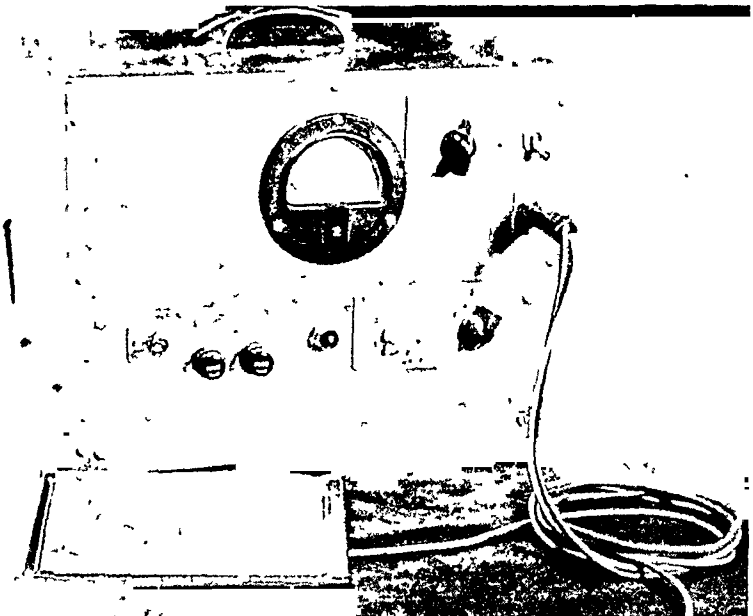

Fig 1 — Photograph of a portable diagnostic stimulator

Diagnostic Instruments — In the selection of a stimulator for diagnostic purposes, one needs only two basic wave forms: direct current, plus an induced or thyratron-triggered tetanizing current. Figure 1 shows a model designed to serve the needs of busy clinicians. It is easily portable from office to bedside and incorporates features for simple, rapid diagnosis. It provides a direct current and a thyratron discharge (duration approximately ½ millisecond, frequency approximately 100 per second). Duration of current flow is automatically regulated to flow in pulses of 0.1 second with an interval of 0.9 second. Automatic internal switching prevents corrosion difficulties with spring-type switches and also the jiggling of tissue caused by manual switching. A polarity switch is furnished for polar reversal testing, and the unit may be unipolar or bipolar in operation. Modifications can be easily made to deliver uninterrupted current for galvanic tetanus ratios.

The usual safeguards are provided Similar instruments are commercially available.

Instruments for Treatment of Innervated Muscle — There are many modifications and variations of the basic wave forms Perhaps the most commonly employed are thyratron discharges (Fig. 2a) and sinusoidal current (Fig. 2b) The thyratron discharges closely resemble true faradic (induced) wave forms (Fig. 2c), not as available in this country as the electronic circuits. True faradic currents possibly have somewhat more "bite" than thyratron discharges, and there is no evidence whatever that they are any more effective The criterion for any wave form should be one that produces a strong tetanic contraction with a minimal amount of pain.

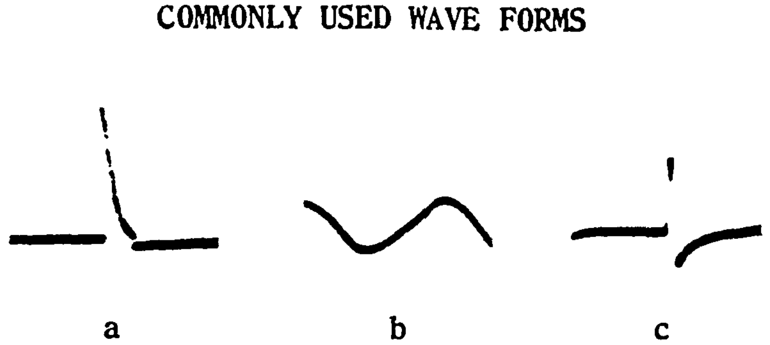

Fig 2 — Photographs of wave forms commonly used for treatment of innervated muscle

Stimulator for Home Treatment of Denervated Muscle — In order to be realistic about treatment of denervated muscle, which sometimes requires a year or more before reneurotization occurs, we designed a unit for home treatment. The home treatment program was devised with two purposes in mind: (1) to maintain the paralytic muscles in optimum nutritional condition for reneurotization and to keep fibrosis and atrophy at a minimum, and (2)

Fig 3 — Photograph of stimulator for home treatment of denervated muscle

to minimize the expense and inconvenience of frequent trips to the Physical Medicine Department, a factor of obvious importance to patients who live some distance from the treatment center.

The prime requisites for a home-treatment unit, besides providing an adequate wave form for stimulation of denervated muscle, are safety and simplicity of operation. Figure 3 is a photograph of the home treament unit in use. This model automatically delivers direct current in pulses of 0.1 second with an interval of 0.9 second. The internal switching eliminates interrupter keys and simplifies operation for the patient. It has a single telephone jack plug so that electrode wires cannot be connected incorrectly. The only controls for the patient to operate are the on-and-off switch and the current intensity knob. The ammeter may be omitted, since strength of contraction rather than milliamperage readings is stressed. Safety features include a heavy-duty transformer so that the patient is not directly in the line circuit and has double fuses rated low so that any slight overload in current will break the circuit. Galvanic burns are impossible.

The cost of manufacture of such treatment units is about $100 each. The patient can rent the apparatus from the physician for a nominal sum, thus avoiding prohibitive costs for treatment and loss of work time and at the same time getting much more continuous care. With the present shortage of physical therapy personnel, such a program would help relieve the situation and release personnel for other needed treatments. Following nerve suture and restoration of joint mobility, patients in government hospitals may either be discharged on no treatment or retained in the hospital for a few minutes of electrotherapy treatment daily. When the per diem is $11.75 and up, this is expensive treatment indeed for 15 or 20 minutes a day.

The patient will probably give himself larger shocks than he will endure from someone else, since he is in complete control of the instrument and can stop at any time. He should carry out stimulation at least twice daily, at maximum tolerable intensity, for about 15 contractions. The technique must be thoroughly demonstrated to him beforehand to convince him of its safety. Specific muscles to be treated are marked with silver nitrate and the patient is given a detailed instruction sheet.

We have used this device on a limited number of patients, with no untoward incidents. Final evaluation of treatment effectiveness will require some years and large numbers of patients.

Summary

1. The effective use of electrotherapy for stimulation of innervated and denervated skeletal muscle is discussed.
2. Requirements for types of wave forms and types of equipment are outlined, including elements of electrodiagnosis.
3. A portable simple office diagnostic stimulator is described.
4. A new home stimulator for prolonged daily treatment of denervated muscle at low expense is presented.

Discussion

Dr. Isadore Levin (Washington, D. C.): Dr. Mead has given us a good review of electrotherapy for innervated and denervated skeletal muscles. He has brought to our attention the latest terminology and thought in regard to the use of such currents not only for therapy, but for electrodiagnosis as well. I agree with him when he states that the older Erb's test is much simpler than most of the newer tests and therefore more in use at present for this reason.

The simple and inexpensive home-treatment unit that Dr. Mead describes sounds like a good idea provided the patient is intelligent and can be trusted to follow instructions and not to do himself harm. I can conceive where such a program can be carried out in a special case that needs treatment daily or twice daily. In cases that may need therapy in the form of electrical stimulation only several times a week, I would prefer, if possible, to give such stimulation in the department and have the patient do the exercises at home. This prevents the patient from losing contact with the physiatrist and allows close supervision.

I would also like to suggest that a low voltage battery apparatus might be safer for home use and would be less dangerous in the hands of a patient than a machine plugged into a house current. I think I would feel less apprehension in prescribing such home therapy with a battery-energized apparatus.

Dr. Sedgwick Mead (St. Louis, Missouri, closing): I want to thank Dr. Levin for his remarks.

I have no objection whatever if any of you are interested in using an alternative apparatus. Such an apparatus can be made very easily. We decided against it on the basis of the fact that batteries gradually would run down and are extremely bulky. By using a stable apparatus, the characteristics of which would not change from month to month, we would be better off.

I stressed in the paper that frequency of review of the patient is important. Doctors who saw our exhibit at Atlantic City were disturbed at the idea that maybe the patient would rent this apparatus from a commercial outlet, and not bother to see the doctor at all. I think that is happening anyway with diathermy apparatus, and other devices. However, I believe it is less likely to happen in a situation where the patient has it explained to him that we are waiting for regeneration of the nerve supply, that periodic review is necessary, and that unsupervised treatment is completely ineffective and sometimes even dangerous.

SOME EFFECTS OF CEREBRAL DIATHERMY ON NORMAL ADULTS *

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and
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The effects of cerebral diathermy have been studied from various aspects. These include: changes in cerebro-spinal fluid,[1] and in the chemistry of blood;[2] abolition of diuresis in the dog due to aminophylline, or in man due to water ingestion[3a b]; and alterations in spinal temperature,[4] and endocrine secretions.[5]

Cerebral diathermy has been used clinically for the treatment of essential hypertension, pituitary dysfunctions, headaches, dizziness and numerous other symptoms. At the present time, it is used empirically in the treatment of hemiplegia due to cerebral thrombosis, where it is believed that the heating will increase local blood supply, presumably by relaxing the vessels which are in spasm surrounding the area of thrombosis.

Actually, little can be found in the literature concerning the physiologic

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* Read at the Twenty-Ninth Annual Meeting of the American Congress of Physical Medicine, Denver, Colo., September 8, 1951.

* Aided by a grant from the National Foundation for Infantile Paralysis, Inc.

* From the Center for Instruction and Research in Physical Medicine, Graduate School of Medicine, University of Pennsylvania.

1. Martucci, A. A.; Hadden, S. B., and McGlone, B.: Treatment of Hemiplegia, Arch. Phys Ther., X-Ray, Radium 15:734, 1934.

2. Looney, J. M., and Borkovic, E. J.: Changes Produced in O_2 and CO_2 Content of Arterial and Venous Blood of Brain During Diathermy for General Paresis, Am. J. Physiol. 136:177, 1942.

3. (a) Michez, J.: Sur l'inhibition de la diurèse euphyllinique après diathermie transcérébrale, Compt. rend. Soc. de biol. 126:1259, 1937. (b) Bentz, W. u. Marks, H.: Untersuchungen zur Diurese. III. Mitteilung: Die Wirkung der Diathermiebehandlung der Hypophysen gegend auf den Wasserausshalt, Arch. f. exper. Pathol. u. Pharmakol. 175:169, 1934.

4. Bierman, W., and Feitelberg, S.: Influence of Short Wave Current on Intraspinal Temperature, Arch. Phys. Ther. 25:263, 1944.

5. Samuels, J.: Short Wave Treatment of the Endocrine System, Arch. Phys. Ther., X-Ray, Radium 19:13, 1938.

effects of cerebral diathermy, especially in normal persons. This study on normals was undertaken as an exploratory investigation in that direction.

Method

All procedures were carried out in a constant temperature room, set at temperatures varying from 16 to 27 C. The fluctuation in room air temperature was approximately ±1.6 C. during each experiment. Each procedure consisted of a thirty to sixty minute control period followed by twenty minutes of cerebral diathermy, after which there was a follow-up period of at least thirty minutes. Pulse, respiration and blood pressure were noted at approximately five minute intervals, while temperatures of the rectum, mouth, right great toe, right middle finger, right and left temples, left ear lobe and room air temperature were recorded, every two minutes, by means of copper constantan thermocouples and a Brown automatic recording potentiometer. Temperature measurements were precise to at least 0.05 C.

The diathermy apparatus utilized was an F. C. C. approved type 27.12 megacycle machine. Electrode pads 5x8 inches, ¼ inch thick, were tied in place on the head bilaterally using four layers of turkish toweling for spacing (figure 1). Skin tolerance was used as a guide for dosage.

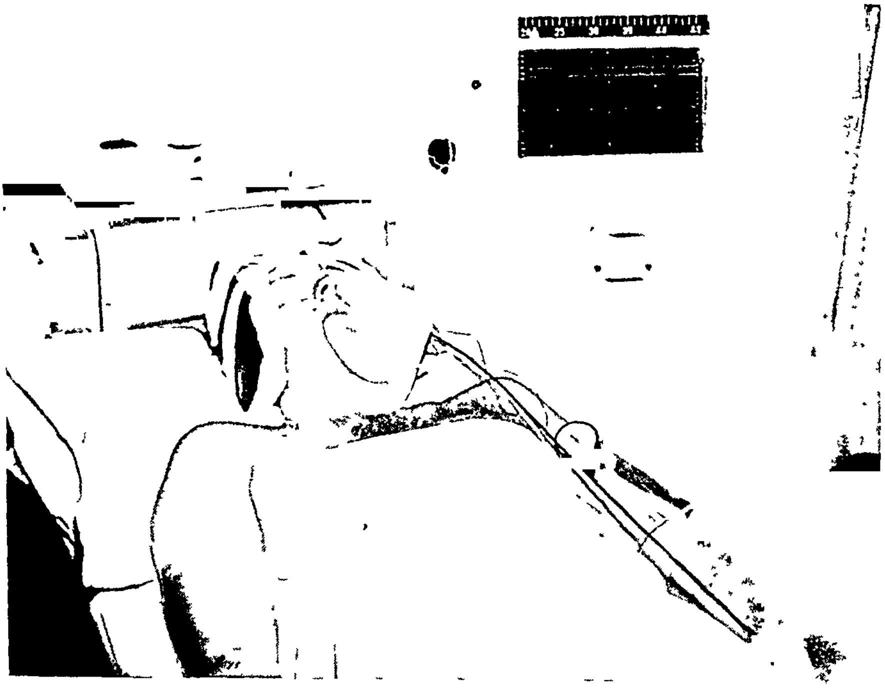

Fig 1. — Method of experiment, showing diathermy apparatus, Brown recording potentiometer, and electrode pads in place on subject.

Fourteen procedures were carried out on eight normal subjects (6 men and 2 women). The thermocouples on the head were insulated during the heating period to prevent local burning. Three control runs were made using similar technique, except that the diathermy machine was not turned on.

Results

(a) *Body and Skin Temperatures* — Body temperature (rectal and oral) was little changed by cerebral diathermy, as shown in figure 2. Rectal temperatures were quite constant, usually to 0.1 C. or better, whereas oral temperatures generally rose in the order of 0.2 to 1 C., as might be expected from proximity to the heating electrodes. The room air temperature varied cyclically (figure 2), and finger and toe temperatures followed the air temperature cycles. The temperature of the face, as measured by thermocouples attached to the ear, and right and left temples, was invariably increased. Erythema of varying degrees was noted. A thermocouple applied to the back of the neck likewise showed a rise in skin temperature. Increase in skin temperature of the face and head was simply the result of local heating due to close contact with the electrodes. Figure 2 shows also a control experiment.

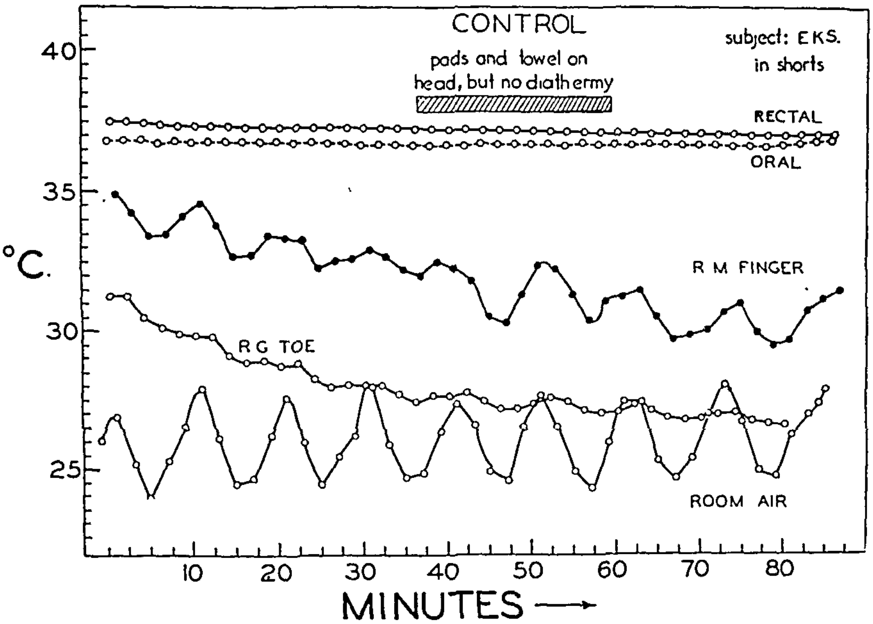

Fig. 2. — Control experiment. Note cyclic variation in the room air temperature and how finger and toe temperatures follow it.

When the air temperature was approximately 23 C. cerebral diathermy caused a partial peripheral vasodilatation as evidenced by increased finger and toe temperatures (figure 3).

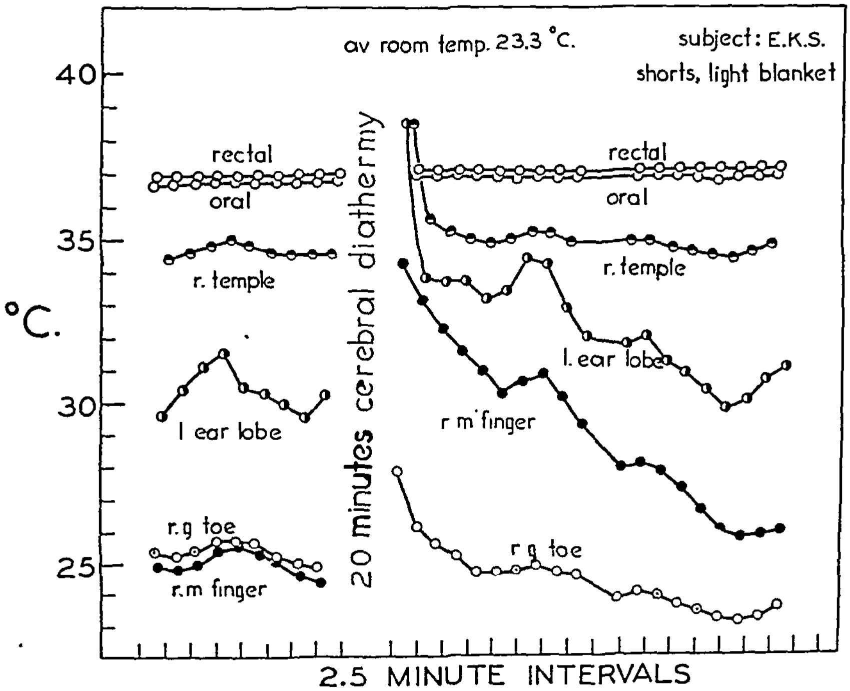

Fig. 3. — Effect of cerebral diathermy on oral, rectal and skin temperatures. Observe increased finger and toe temperatures after diathermy, showing partial vasodilatation of the toe and complete vasodilatation of the finger.

In none of our cases was complete general peripheral vasodilatation produced by cerebral diathermy. The criterion for full vasodilatation in the normal individual as given by Montgomery, et al.[6] is digital temperature rising to a level between 31 and 34 C. When the room was cold enough to give rise to intense vasoconstriction, cerebral diathermy did not produce detectable vasodilatation (figure 4).

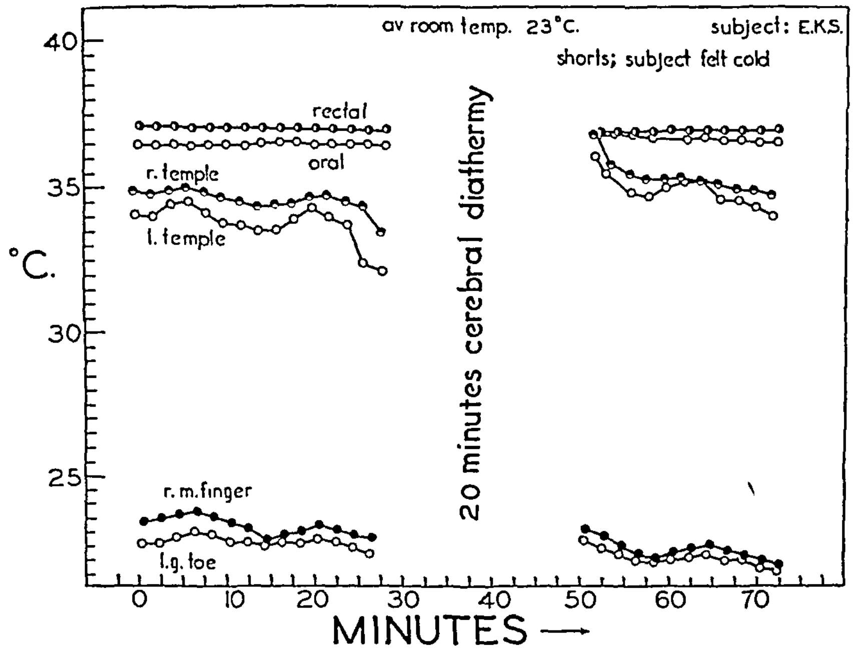

Fig. 4. — Failure of cerebral diathermy to produce peripheral vasodilatation in the presence of marked vasoconstriction. Compare the results in this graph, where the subject felt cold, with figure 3, where the subject was under a light blanket, and felt comfortable.

(b) *Pulse, Blood Pressure and Respiration.* — There was usually no significant change in pulse, blood pressure or respiration during mild diathermy of 20 minutes duration. With longer treatment, the subject may perspire freely and show increase of pulse rate and blood pressure, as observed also by Martucci, et al.[1] One subject complained of headache during the latter part of a 37 minute exposure. Several subjects at rest normally had irregular respirations and this did not change with diathermy. Figure 5 shows a typical blood pressure, pulse and respiration record.

(c) *Estimation of Time.* — Although quantitative measurements were made of skin temperatures, the temperature of the brain remained an unknown factor, since thermocouples obviously could not be directly inserted. Yet the basic assumption in the use of cerebral diathermy is that a rise of brain temperature results. From the work of Hoagland and Perkins,[7] it is known that subjective estimation of time is a function of body temperature, and accordingly an attempt was made to use this information as a guide to cerebral temperatures. Subjects were requested to indicate at regular intervals their estimate of the passage of time by tapping seconds on the bed with the left index finger, and the time for thirty taps was measured with a stopwatch. Averages were taken of sets of determinations during application of diathermy, and during the pre- and post-diathermy periods. A complicating factor became at once evident, appearing uniformly in all subjects, viz., the supervention of drowsiness of varying degrees with the application of diathermy, (and the illusion of warmth over the body). During the heating period subjects had increasing difficulty in concentrating on tapping. Together with the question of the importance of the role of training in making measurements of this nature (subjects were simply asked to tap at what they considered second intervals), the drowsiness factor made it difficult to utilize subjective estimation of time as an index to temperature of the cerebral tissues.

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[6] Montgomery, H.; Naide, M., and Freeman, N. E.: The Significance of Diagnostic Tests in the Study of Peripheral Vascular Disease, Am. Heart. J. 21:780, 1941.

[7] Hoagland, H., and Perkins, C. T.: Some Temperature Characteristics in Man, J. Gen. Physiol. 18:399, 1935.

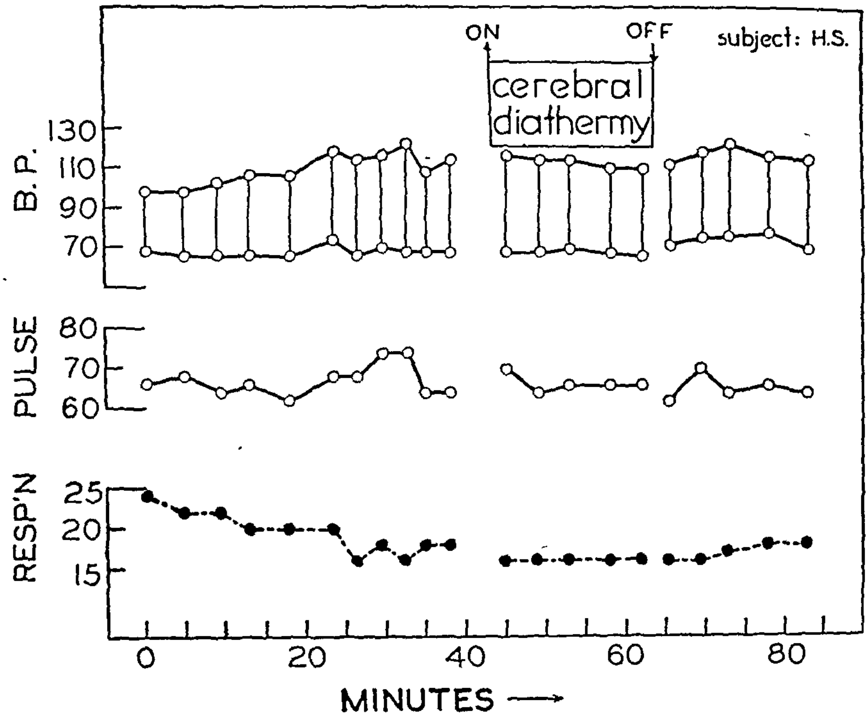

Fig. 5. —Effect of mild cerebral diathermy on pulse, respiration and blood pressure. Note absence of any significant effect.

In experiments reported by Mangold, et al. (abstracted in American Journal of Medical Sciences, 221:712, June, 1951, entitled, "Blood Flow and Oxygen Consumption of the Human Brain During Sleep") it was found that the cerebral blood flow of eight healthy young men averaged 58.0 cc./100 gm./min., after some twenty hours of wakefulness, and increased to 63.7 cc. during sleep. Cerebral oxygen consumption was not significantly changed. The increase in cerebral blood flow was attributed to a decrease in cerebrovascular resistance. In the present experiments, cerebral diathermy produced drowsiness. Martucci, Hadden and McGlone[10] stated that insomnia in man was consistently relieved by cerebral diathermy.

After diathermy was stopped the languid feeling disappeared, subjects felt alert, and were able to tap second intervals without hesitation or stopping. Upon arising, after the follow-up period, there was generally a feeling of weakness, tiredness in the legs, and in one case slight muscular incoordination of the legs for several hours. This is interpreted as a persisting effect on the motor area of the cerebral cortex, or on the cerebellum, rather than a direct muscular effect. No other subjective symptoms were noted.

Discussion

Mart and Miller[8] in a study of the effect of diathermy on coronary blood flow in dogs, using a method admittedly open to criticism, found that although heart muscle temperature was increased there was no increase of blood flow over that of the controls. Various clinical reports[9a-b] have empirically attributed to diathermy a definite efficacy in the treatment of angina pectoris.

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[8] Mart, J. A., and Miller, J.: The Effect of Diathermy on Coronary Flow. An experimental study on dogs, Am. Heart J. 29:390, 1945.

It is probable that where blood supply is diminished below normal because of spasm, heat can increase the circulation toward normal by inducing a moderate degree of vasodilatation. The same argument can be advanced for suggesting the use of cerebral diathermy in the treatment of hemiplegia. It has been shown by Martucci, Hadden and McGlone[10] that pial vessels do dilate during diathermy, but the problem of proving that the circulation in any given localized area of injured brain can be increased is a difficult one. The present day techniques of determining cerebral blood flow by the N_2O method of Kety and Schmidt[11] or the dye method of Gibbs, et al.[12] do not provide such specific information; neither do current techniques of arteriography, electroencephalography or photography of the retinal vessels. The pial vessels together with their intracerebral branches are equipped with nerves. Removal of sympathetic and parasympathetic innervation does not denervate cerebral vessels completely.[13] Stimulation of the cervical sympathetics causes mild constriction of the pial vessels, except in the parietal region.[14] Pentylenetetrazol (Metrazol^R) administered to monkeys[15] and caffeine to cats under amobarbital (Amytal®) (but not ether) anesthesia[16] have been found to dilate cerebral vessels. Cobb and Lennox[14] have summarized the effects of drugs on cerebral vesels in animals (including man).

According to Forbes, et al.[17] (see also Cobb, et al.[18]) stimulation of the vagus, aortic and carotid sinus nerves produces pial vasodilatation only indirectly as a consequence of reflex splanchnic vasodilatation with subsequent fall in blood pressure. It is held that only by this fall are the cerebral vessels affected. The pial vessels appear to dilate because of sudden slowing of the blood flow, due to lowered pressure. This vascular reaction is important in that it permits the cortex to obtain more oxygen than would otherwise be possible when the blood pressure falls to a dangerously low value.

Our present day feeling concerning cerebral circulation is that the cerebral vessels are to a large degree independently controlled by both nervous and chemical influences.[15] In cerebral thrombosis, it is postulated that early there is only a very small area of damage surrounded by a larger area of tissue suffering from anoxia due to vasospasm. Therefore, any method which would tend to relieve vasospasm should benefit those persons with cerebral thrombosis, if instituted early enough. Injections of Metrazol^R, caffeine or neostigmine (Prostigmine®) stellate ganglion blocks and heat in the form of diathermy are the procedures which have been followed in the attempts to achieve this.

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9. (a) Blackman, W. W., and Richardson, J. L.: Diathermy in Coronary Thrombosis, Arch. Phys. Ther., X-Ray, Radium 19:412, 1938. (b) Hyman, A. C.: [illegible] rol of Diathermy in Angina Pectoris and Coronary Artery Disease, Arch. Phys. T. [illegible] 14.270, 1933. in Angina Pectoris and Coronary Artery Disease, Arch. Phys. [illegible] 14:270, 1933.

10. Martucci, A. A.; Hadden, S. B., and McGlone, B.: [illegible] Transcerebral Diathermy, Arch. Phys. Ther., X-Ray, Radium 18:426, 1937.

11. Kety, S. S., and Schmidt, C. F.: The Nitrous Oxide Method for the Quantitative Determination of Cerebral Blood Flow in Man, Theory, Procedure and Normal Values, J. Clin. Invest. 27:476, 1948.

12. Gibbs, F. A.; Maxwell, H., and Gibbs, E. L.: Volume Flow of Blood Through the Human Brain, Arch. Neurol. and Psychiat. 57:137, 1947.

13. Chorobski, J., and Penfield, W.: Cerebral Vasodilatation of Nerves and Their Pathway from the Medulla Oblongata, Arch. Neurol. and Psychiat. 28:1257, 1932.

14. Cobb, S., and Lennox, W. G.: Cerebral Circulation-Intrinsic Control and Clinical Phenomena, Fed. Proc. 3:151, 1944.

15. Schmidt, C. F.: The Present Status of Knowledge Concerning the Intrinsic Control of the Cerebral Circulation and the Effects of Functional Derangements in It, Fed. Proc. 3:231, 1944.

16. Finesinger, J. E.: Cerebral Circulation, XVIII. Effect of Caffeine on Cerebral Vessels, Arch. Neurol. and Psychiat. 28:1290, 1932.

17. Forbes, H. S.; Mason, G., and Wortman, R. C.: Cerebral Circulation, XLIV. Vasodilatation in the Pia Following Stimulation of the Vagus, Aortic and Carotid Sinus Nerves, Arch. Neurol. and Psychiat. 37:334, 1937.

18. Cobb, S., and Finesinger, J. E.: Cerebral Circulation, XIX. The Vagal Pathway of the Vasodilator Impulses, Arch. Neurol. and Psychiat. 28:1243, 1932.

Since cerebral diathermy, properly controlled, can be given easily, quickly and safely to patients, clinical investigation and use of it is warranted.

Summary and Conclusions

1. Mild cerebral diathermy in normal adults produced no marked change in blood pressure, pulse or respiration (figure 5).
2. Cerebral diathermy, like diathermy elsewhere on the body, can cause peripheral vasodilatation if environmental temperature is not too cold for a given individual, and if the quantity of heat developed is sufficient (figure 3).
3. Cerebral diathermy produced drowsiness and reduction in ability to concentrate, both objectively and subjectively.
4. Following cerebral diathermy there was mental alertness, but physically a feeling of tiredness and weakness of the lower extremities which was transient in nature.

Discussion

Dr. Albert A. Martucci (Abingdon, Pa.): I have kept in contact with the scientific work of Dr. Stoner and Dr. Shapiro concerning the effects of cerebral diathermy on the adults. I wish to congratulate the authors on this difficult and scientific approach to the problem of cerebral circulation. There is no question that there is need for further scientific exploration concerning the effect of cerebral diathermy.

New methods of approach to this problem are in the making. At the time of our original investigation in transcerebral diathermy, conventional diathermy or long wave diathermy was the only type of apparatus available. Later, records were secured by the use of an ultratherm of six (6) meter wavelength. No attempt was made to calibrate room temperatures or the effect of reflex surface temperature, and for this reason I believe the work of Stoner and Shapiro gives us more proper scientific data than which have already been obtained.

We have to assume empirically that temperature of the brain is increased and circulation of the brain is increased. We must also assume that the oxygen content of the brain cell is increased by the improved circulation. These assumptions are made as a result of the scientific work on the effects of diathermy upon other tissues of the body.

Kety has attempted to demonstrate the values of cerebral circulation and metabolism, and his methods of determination are exceedingly complicated to formulate. Shenkin, Harmel and Kety have demonstrated the dynamic anatomy of the cerebral circulation. Kolb and Talbott have described the quantitative studies of the cerebral capillaries. But, my work with Hadden and McGlone, and our clinical observations, demonstrated especially in the diathermy applications to the hemiplegic brain, that a certain amount of relaxation was obtained in the spastic extremities, and improvement in sleep was noted. Improvement in mental condition, from a morose, depressed feeling to one of cheerfulness and hope was also noted. There was also improvement in speech. The above improvements have also been noted in the recent introduction of the stellate ganglion block. I refer to the recent works of Dr. Ruben of Philadelphia. I feel, after sixteen (16) years of clinical use, that cerebral diathermy is a safe procedure.

A word of caution must be given that this type of treatment should not be given promiscuously without definite study and evaluation of the patient. There is no doubt that further direct scientific data are necessary to corroborate the above clinical results. I hope that Drs. Stoner and Shapiro will continue their study, so that more scientific data can be obtained.

PRECISION OF ELBOW FLEXION ERGOGRAPHY UNDER VARYING DEGREES OF MUSCULAR FATIGUE *

H. HARRISON CLARKE, Ed.D.

SPRINGFIELD, MASS.

Purpose of the Study

As a preliminary investigation into strength proportions relative to work output, Fjeldal[1] studied the following two factors: (1) the precision with which ergographic measurement of elbow flexion movements may be applied to untrained subjects; and (2) a survey of ergographic weight loads to use in fatigue measurement of this same muscle group. Difficulty was encountered in using ergograph as a precision instrument for laboratory experimentation: Fjeldal obtained a correlation coefficient of 0.74 between repeated elbow flexion ergographic fatigue tests on the same subjects.

The present project was undertaken to study more exact methods of applying erography. Specificially, it had three major purposes related to the precision of elbow flexion fatigue testing, as follows: (1) To determine the effect upon precision of ergographic testing of improved methods of stabilizing the subjects and of co-ordinating their relation to the ergograph under conditions of mild to moderate muscular fatigue; (2) to study the effect upon results obtained from ergographic testing of repeated practice sessions by the subjects; (3) to investigate the effect upon precision of ergographic testing of different weight loads, including conditions inducing exhaustion efforts.

The Subjects

The subjects utilized in this research were thirty-one male students at Springfield College, nearly all of whom were upper classmen. In their selection, the following criteria were applied on the basis of prior acquaintance with the subjects and observation of them during the initial stages of the study:

(1) No prior experience with ergographic exercise; (2) complete willingness to cooperate at all times during the experiment; (3) possession of a sufficient sense of rhythm to keep in time with a metronome.

The selected subjects were paid an hourly wage of $1.00 as an additional incentive to participate fully in the study.

Inasmuch as the subjects participating in this research were physical education majors, they were thought to be physically superior to college students in general. Because the nature of the subject might be a factor in the results of an experiment requiring sustained physical effort, data were collected to define further the physical status of the group. Following is a brief summary of these data:

(1) *Age.* — Mature: between 20 and 26 years, with a median age of 24 years.

(2) *Height.* — Fairly normal: between 64 and 74 inches; interquartile range from 67 to 70 inches, inclusive; median height of 69 inches.

(3) *Weight.* — Heavier than normal for height, due to body type and muscular development: between 134 and 200 pounds; interquartile range from 153 to 171 pounds inclusive; median weight of 160.5 pounds.

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* Read at the Twenty-Ninth Annual Session of the American Congress of Physical Medicine, Denver, Colorado, September 6, 1951.

[1] Clarke, H. H.: Research Projects Utilizing Objective Strength Tests by Cable-Tension Methods. Unpublished Report, Springfield College Library, 1950, chapter VIII.

(4) *Strength Index.*[2] — Above average in gross strength: between 2225 and 3836; interquartile range from 2630 to 3100 inclusive; median SI of 2987.

(5) *Physical Fitness Index.*[3] — Above average: between 75 and 150; interquartile range from 93 to 120 inclusive; median of 103.5.

(6) *Body Build.* — Athletic types: somatotypes[4] of subjects, in general, dominantly mesomorphic; some tendency toward ectomorphy.

(7) *Athletic Activity.* — Active in athletics during current year: all subjects engaged in intramural athletics; 59 per cent were on junior varsity teams; 56 per cent on varsity teams.

The Ergograph

F. A. Hellebrandt, M.D., et al.,[5] have provided a comprehensive review of the origin and development of ergography. Mosso[6] is credited with designing the first ergograph, which was utilized for exhaustive studies on the fatigue of human muscles, confining the research to finger movements. In the years which followed, many changes in this instrument were proposed and utilized in muscle fatigue experimentation. None of these, however, could compute accurately the total work done by contracting muscles as the angle of pull changed throughout the range of motion of the joint.

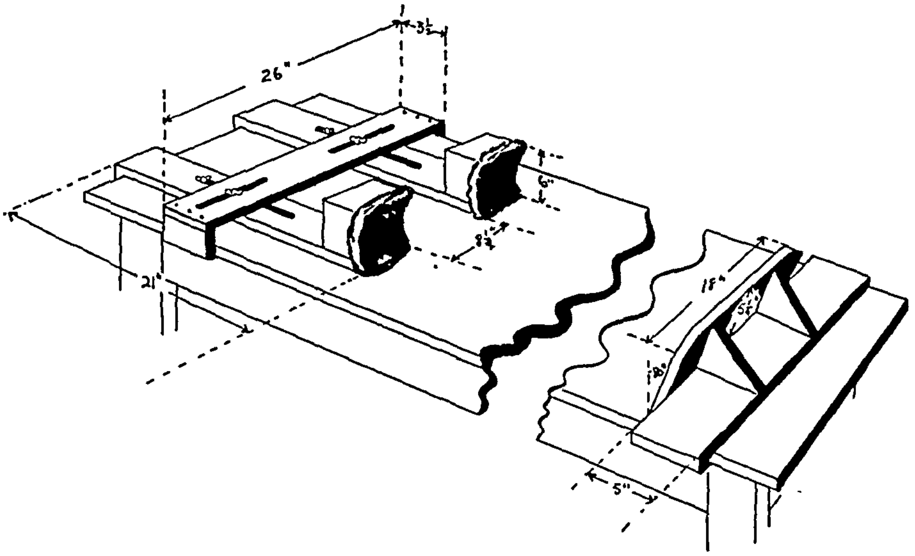

Fig. 1. — Diagram of construction of adjustable shoulder and foot braces utilized to stabilize subjects in elbow flexion ergography.

More recently, Kelso, in cooperation with Hellebrandt, devised a bell crank, or wheel and axle, in place of the Mosso sling. A bar was attached to the wheel and the part of the body under study (i. e., the forearm, as in this research) moves this bar which in turn moves the wheel. Thus, the angle of resistance remains the same during the entire movement.

Located in the tower of the ergograph are two counters: one of these records the number of movements made by the subject; the other is a distance meter which records cumulatively in centimeters the total distance the subject raises the load. Attachments for a kymograph, electro-magnetic signal, mechanical chronograph; synchronous motor, and voltage reduction and insulating transformer are provided.

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[2] The Strength Index is the gross score obtained from the following tests: lung capacity, right and left grip strengths, back lift, leg lift, and arm strength (obtained from push-ups and pull-ups). See: Clarke, H. H.: Application of Measurement to Health and Physical Education. Ed. 2, New York, Prentice-Hall, Inc., 1950, chapter VIII.

[3] The Physical Fitness Index is computed by dividing the individual's strength index by a norm for his sex, weight, and age. A PFI of 100 is an average score for normal populations.

[4] Sheldon, W. H.; Stevens, S. S., and Tucker, W. B.: The Varieties of Human Physique. New York, Harper & Brothers, 1940.

[5] Hellebrandt, F. A.; Skowlund, H. V., and Kelso, L. E. A.: New Devices for Disability Evaluation: 1. Hand, Wrist, Radioulnar, Elbow, and Shoulder Ergograph, Arch. of Phys. Med. 39:23 (Jan.) 1948.

[6] Mosso, A.: Fatigue, translated by M. and W. B. Drummond. New York, Putnam, 1904.

Hellebrandt and associates have used the Kelso ergograph extensively in studies pertaining to disability evaluation. The same type of instrument was utilized in this research to measure the fatiguability of the elbow flexor muscles; this was constructed under the direction of Professor Kelso at the College of Engineering, University of Wisconsin. Guidance in the use of the ergograph was provided by Dr. Hellebrandt.

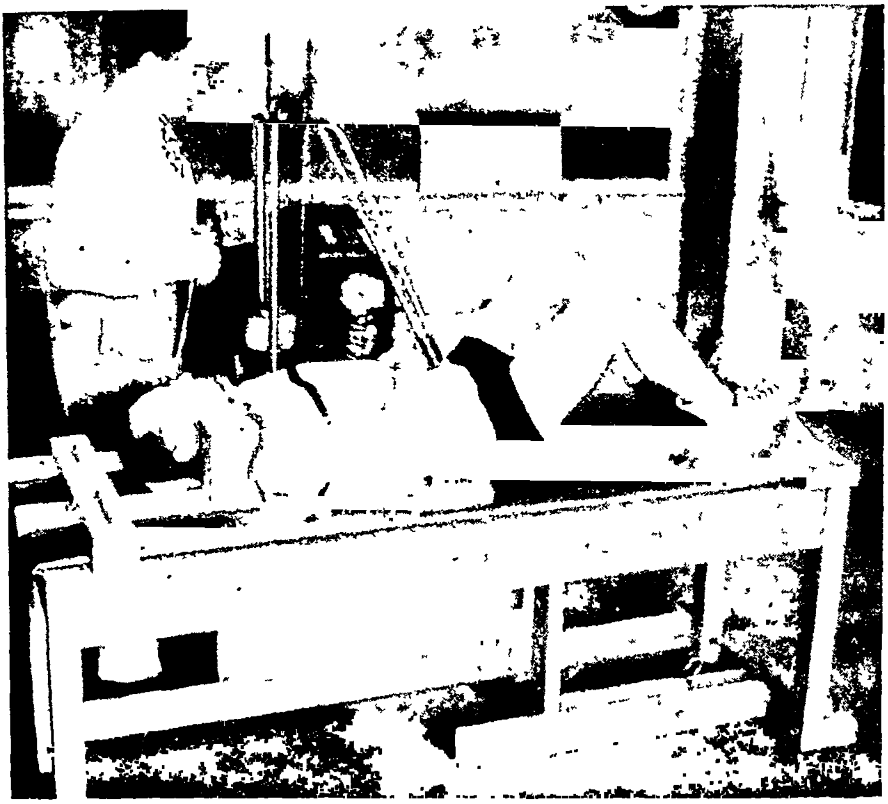

Fig. 2 — Position of subject for elbow flexion test bouts with Kelso Hellebrandt ergograph

Ergographic Testing Techniques

A basic problem of this research was so to control the subjects and coordinate them to the ergograph that precise (repeatable) results could be obtained. In an earlier study in the precision of ergography, Fjeldal[7] had difficulty in stabilizing his subjects while they were performing elbow flexion exercises. As a consequence, based upon suggestions made by Hellebrandt, special adjustable braces were attached to a plinth to hold the subject's shoulders and feet in proper position. Details for the construction of these braces appear in figure 1.

In determining the techniques of ergographic testing for this experiment, every effort was made to objectify them so that different testers could obtain comparable results. The techniques are illustrated in figure 2:

1. Prior to the initial test bout each day, an elbow flexion strength test was administered to each subject. This testing technique was based on cable-tension methods, as developed by Clarke and his associates,[8] illustrated in figure 3 and described under that subtitle.

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[7] Clark, *cp cit*

[8] Clarke, H. H. Improvement of Objective Strength Tests of Muscle Groups by Cable-Tension Methods, Research Quarterly 21:399 (Dec) 1950.

1a. *Position.* — The subject lies supine, with hips and knees flexed, the feet resting on the table, and the free arm on the chest. The arm being tested is adducted and extended at the shoulder to 180 degrees; the elbow is flexed to 115 degrees; and the forearm is in mid-prone-supine position.

1b. *Attachment.* — A strap is placed around the forearm midway between the wrist and elbow joints. A cable is attached below and at the feet of the subject; it is arranged at a right angle to the forearm and parallel with the median line of the body.

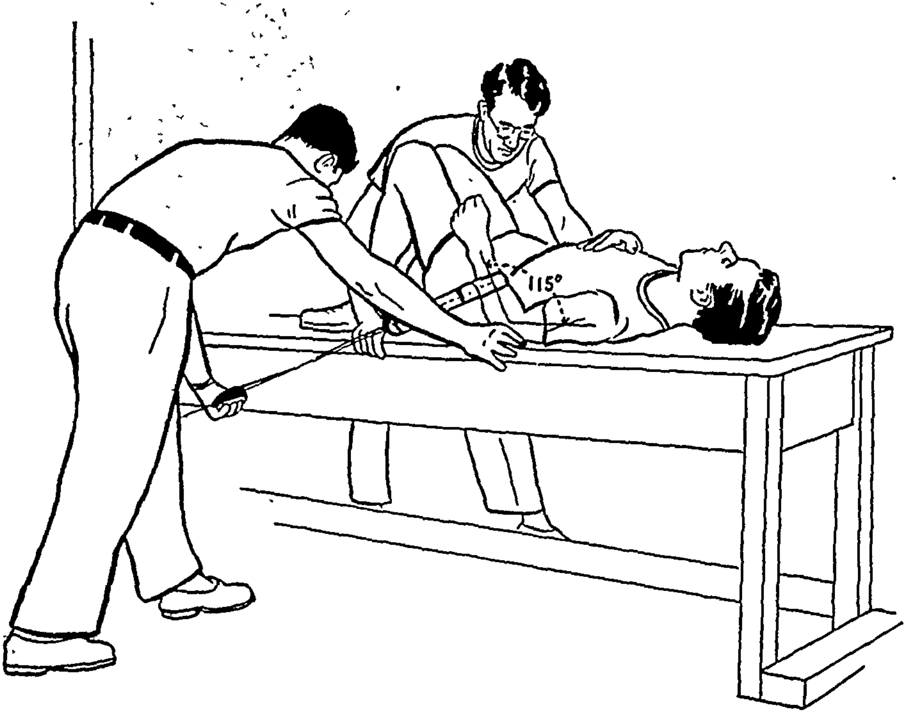

Fig. 3. — Elbow flexion strength test by cable-tension methods.

1c. *Stabilization.* — The tester prevents elevation of the elbow and abduction of the upper arm by bracing.

1d. *Strength Record.* — The amount of tension the subject can apply to the cable is recorded with a tensiometer.

2. A load equal to a selected proportion of each subject's elbow flexion strength was placed on the ergograph carrier.

3. The position of the subject's body for each ergographic test bout was the same as for the elbow flexion strength test. The shoulders and feet were placed firmly against their respective braces.

4. The left arm was tested in each instance. The center of the elbow joint was located opposite the bell-crank shaft of the ergograph.

5. At the end of the lever arm, an archery arm guard was attached, lined with ¼-inch sponge rubber pad for comfort. The arm guard was strapped firmly to the subject's forearm.

6. Before testing, each subject was permitted two or three preliminary elbow flexions in order to be sure that the adjustments to the ergograph were correct and comfortable and to accustom him to the resistance that must be moved with each contraction.

7. The numbers on the repetition counter and distance meter were recorded prior to each test bout.

8. The metronome, set for one-second movements, was started. The subject began his movements when ready. The tester counted the cadence aloud, so that the subject was constantly aware of the number of movements completed.

9. Throughout the test bout, the subject continued to flex and extend his elbow, keeping in cadence with the metronome and obtaining maximum movements throughout. The necessity for maintaining the cadence was stressed, even though the subject was unable to make full flexion movements as the test bout progressed.

10. The repetition counter and distance meter were read immediately after the completion of each test bout. The repetition counter provided a check on the number of movements each subject made. The cumulative distance the subject lifted the weight load was determined from the distance-meter readings. This distance (in centimeters) was multiplied by the weight of the load (in grams). Thus, the amount of work done for each test bout was recorded in centimeter-grams. The effect of tiring muscles is reflected in this score by inability to raise the forearm the full distance. The same effect would be obvious on a kymograph tracing by shorter lines on the graph.

Control of Experimental Factors

In general, the following experimental factors, which might logically influence the results of ergographic testing were controlled in this research:

1. *Training of Testers.* — Before recording ergographic test scores, the testers were instructed in testing techniques and went through a period of supervised practice.
2. *Rotation of Testers.* — The testers systematically changed their testing assignments as the experiment progressed. In this way, it was possible to determine the precision of ergographic testing when different testers are involved.
3. *Orientation of Subjects.* — Prior to testing, the subjects were briefed regarding the purposes of the experiment; and the testing techniques were described and demonstrated. No practice on the ergograph was permitted, as one phase of the study was to determine the practice effect on elbow flexion ergography.
4. *Scheduling Subjects.* — Each subject was scheduled for testing on the same day and hour each week of the experiment in order to reduce the possible effect of changes in daily activities on ergographic performance.
5. *Duration of Test Bouts.* — With the exception of all-out efforts made by the subjects at the end of the research, the length of test bouts was standardized at two minutes each.
6. *Cadence of Test Bouts.* — The cadence for all test bouts was set at one contraction and relaxation of the elbow flexor muscles each two seconds. Thus, the subject completed sixty movements during each two-minute period.
7. *Length of Lever Arm.* — Since individuals with long arms might be at some disadvantage when exercising on the ergograph, the length of the lever arm on the ergograph itself was placed at eight inches.
8. *Ergograph Weight Loads.* — The amount of ergograph weight load for each subject was determined objectively by taking a definite proportion of the strength of his elbow flexor muscles.
9. *Rest Between Bouts.* — A rest period of ten minutes between test bouts during daily testing of each subject was adopted as standard performance. This amount of rest was justified on the basis of Yochelson's finding that 95 per cent recovery in ergographic performance resulted from eight-minute rest periods.[9]

Precision of Ergographic Testing Under Conditions of Mild to Moderate Muscular Fatigue

Procedure. — The first experimental phase of this research was to determine the precision with which ergographic testing of the elbow flexor muscles can be applied utilizing the techniques and procedures described. For this purpose, the ergograph weight load for each subject was only sufficient to induce mild to moderate muscular fatigue; in no instance was an exhaustion state reached. Thus, the additional complications encountered in exhaustion efforts were avoided.

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[9] Yochelson, S.: Effects of Rest Pauses on Work Decrement, New Haven, Unpublished Doctoral Study, Yale University, 1930, p. 98.

The amount of weight placed on the ergograph carriage for each subject was a one-eighth proportion of the strength of his elbow flexor muscles. Fjeldal had previously found that all of his subjects could complete test bouts with this proportion.

Each subject was scheduled once each week for three weeks; four test bouts were completed at each session. Thus, the results of twelve test bouts were recorded during this phase of the experiment.

Weekly Precision Testing. — In order to obtain an index of precision for ergographic objectively testing, coefficients, in the form of coefficients of correlation were computed for each week of testing. These coefficients represent the degree of repeatability of results obtained in ergographic testing by the same subjects with the tests being given by different testers. The correlations appear in table 1.

TABLE 1. — *Objectivity Coefficients Between Test-Bouts for Each Week of the Experiment.*

Bouts	First Week	Second Weeek	Third Week
1 *vs.* 2	.94	.94	.97
2 *vs.* 3	.96	.97	.98
3 vs. 4	.90	.96	.98

As 0.90 is the accepted standard indicating desirable objectivity for physical performance tests, the precision of ergographic testing was found to be entirely satisfactory under the conditions defined and with the type of subjects utilized in this experiment. These results were amply verified with nine such correlations, ranging from 0.90 to 0.98.

Inter-Week Testing. — A further step in determining the precision of ergographic testing was to correlate the results of the last test bout each week with the first test bout of the following week. These correlations were found to be low, as follows:

	Coefficient of Correlation
1. Last test, first week, *vs.* first test, second week	.47
2. Last test, second week, *vs.* first test, third week	.53

An attempt was made to account for these low correlations. A possible cause could be differences in elbow flexion strength in the weekly testing, which, of course, would result in different weight loads to be placed on the ergograph. A realization on the part of the subjects that their best pull would mean heavier weights might well account for this situation, although maximum efforts were encouraged at all times by the testers.

To check on this possibility, correlations were computed between elbow flexion strength scores obtained by the subjects for the first, second, and third weeks. The resulting coefficients were as follows: first and second weeks, 0.43; second and third weeks, 0.52. As the established objectivity coefficient for the elbow flexion strength test is 0.92, these results confirm the hypothesis that the strength test results for the various weeks were not consistent.

As a further check on inter-week consistency in ergographic testing, the weight load for the first bout of the fourth week of testing was kept the same for each subject as the amount used the preceding week. The correlation between ergographic test scores for this test bout and the last bout of the third week was 0.91. Thus, the precision of the ergographic testing of elbow flexion muscles appears assured. However, this latter experience does emphasize the need for careful strength testing to determine ergograph weight loads, if a comparison of total work done is to be made.

Length of Ergograph Lever Arm. — Throughout this research so far, the length of the ergograph lever arm remained constant at eight inches. In order to determine the effect on ergographic performance with different lengths of lever arms, the subjects were tested in ths usual manner during a single period of testing with the following lengths: (1) the regular eight-inch length; (2) at a point midway between the elbow and wrist joints of each subject; and (3) with the handle of lever arm held in palm of hand.

The coefficients obtained from inter-correlating the results of ergographic testing with these different lengths of lever arms were as follows:

	Coefficient of Correlation
1. Eight-inch lever arm *vs.* mid-forearm position	.95
2. Eight-inch lever arm *vs.* palm of hand	.93
3. Mid-forearm position *vs.* palm of hand	.90

These correlations are entirely satisfactory, so it may be concluded that precision in ergographic elbow flexion testing can be achieved with any length of lever arm.

However, the tester must not interchange lengths of the lever arm if he is to compare the total work done by the subjects under these conditions, as this amount varies. The average amounts of work done by the subjects with the different lengths were as follows:

Eight-inch lever	217,976 cm.-gms.
Mid-forearm position	195,564 cm.-gms.
Palm of hand	274,130 cm.-gms.

In comparing these averages, the greatest amount of work done was with the lever arm adjusted to the palm of each subject's hand. The average for this length was 78,566 cm.-gms. greater than for the mid-forearm position; and 56,154 cm.-gms. greater than for the eight-inch lever. The *t*-values for these differences are 10.23 and 7.13, respectively. The differences are statistically significant, as a *t*-value of 1.70 is significant for 31 cases at the .05 level of confidence; and 2.46, at the .01 level. These values for *t* were chosen because, in this study, significance was measured from zero, or no difference, in a positive direction only. It should be explained that when the hypothesis tested postulates a difference in one direction only, the probability yielded by *t* as given in ordinary tables is halved.[10]

The use of the eight-inch lever yielded an average which was 22,142 cm.-gms. greater than for the mid-forearm position. This difference has a *t*-value of 3.37, which also indicates statistical significance beyond the 0.01 level of confidence.

Whether these same results would occur when the ergographic testing is carried to exhaustion is not known. In the present research, the subjects were well within their fatigue tolerance at all times. Thus, the longer lever arms required greater effort and were more fatiguing. However, none of them induced exhaustion states with these subjects.

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[10] Fisher, R. A.: Statistical Methods for Research Workers, ed. 10, London, Oliver & Boyd, Ltd., 1946, p. 118. Garrett, H. E.: Statistics in Education and Psychology, ed. 3, New York, Longmans, Green & Co., 1949, pp. 190, 197-208.

Effect of Practice Upon Ergographic Testing

The second experimental phase of this research was to determine the effect of practice upon ergographic testing of the elbow flexor muscles under conditions of mild to moderate muscular fatigue. A comparison of the mean scores of the subjects for successive bouts during the first three weeks of the experiment was obtained and comparisons made. These data appear in table 2.

TABLE 2. — *Comparison of Average Work Output for Twelve Successive Ergographic Elbow Flexion Test Bouts.*

Test-Bouts	Averages	Difference Between Averages	Standard Error of Difference	*T*-Values
First Week —				
1 vs. 2	208,910 *vs.* 207,191	—1719	7438	.23
2 vs. 3	207,191 *vs.* 208,596	+1395	7391	.19
3 vs. 4	209,876 *vs.* 210,117	+2410	7312	.33
Second Week —				
5 vs. 6	206,055 *vs.* 205,807	—248	7184	.03
6 vs. 7	205,807 *vs.* 203,223	—2584	7233	.36
7 vs. 8	207,217 *vs.* 208,334	+1117	7228	.15
Third Week —				
9 vs. 10	216,348 *vs.* 212,670	—3678	7418	.49
10 vs. 11	215,210 *vs.* 214,100	—1110	7206	.15
11 vs. 12	214,500 *vs.* 213,577	—923	6894	.13

The *t*-values of all differences are very low, none being even close to the 1.70 and 2.46 required for statistical significance at the .05 and .01 levels of confidence. As a consequence, such differences as do exist may be accounted for as chance errors.

To check the over-all effect of practice, the difference between the first and last test bouts was computed. This difference was 14,667 ± 10,142 cm.-gms.; the *t*-value is 1.45. Although there appears to be a small but consistent gain in work output for the twelve test bouts, the amount is too small to be statistically significant. Whether these same results would hold true for exhaustion testing is not known.

Effect of Increased Weight Loads Upon the Precision of Elbow Flexion Ergography

Up to this point, the amount of weight placed on the ergograph carriage was only sufficient to induce mild to moderate muscular fatigue of the elbow flexor muscles. Thus, the various factors peculiar to extreme efforts (i. e., willpower, motivation, willingness to make extreme efforts, and the like) were not dominant in the situation. As a consequence, the third phase of this research was to investigate the effect of heavier weight loads, including exhaustion testing, upon the precision of ergographic measurement.

In this phase of the research, all ergographic testing techniques and procedures remained the same as formerly except as noted below. The problem was approached in three steps, as follows:

1. *Increased Loads With 10-Minute Rest Periods Between Test Bouts.* — In this step, the precision of ergographic testing was checked when weight loads of three-sixteenths and one-fourth proportions of each subject's elbow flexion strength were used. So as to neutralize the fatigue effect upon either

load of a favored position in the sequence of testing, the order of tests was randomized, as follows: for one-half the subjects, the one-fourth proportion was in first and third positions; for the other half, it was in second and fourth positions. The usual ten-minute rest periods were in force between test bouts.

Upon the completion of the ergographic testing, coefficients of correlation were computed separately for the work done for the three-sixteenths bouts and for the one-fourth bouts. The results were as follows:

	Coefficients of Correlation
Three-sixteenth vs. three-sixteenth bouts	.86
One-fourth vs. one-fourth bouts	.78

For the first time, the correlations between test bouts in ergographic testing fell below 0.90. The results of the one-fourth bouts were particularly low. To investigate possible causes for this situation the next step was undertaken.

2. *Increased Loads With Lengthening of Rest Periods Between Bouts.* — In the second step, one-fourth loads only were used. The only other changes in ergographic testing procedures were: only two test bouts were accomplished during each period; the rest period between bouts was extended to thirty minutes; and the first bout was preceded by a brief warm-up, in which a one-eighth load was placed on the ergograph and the subject exercised in the usual manner for one minute.

The coefficient of correlation between the work done during the two one-fourth loads were 0.95. Thus, it was found that the precision of the ergographic testing remained satisfactory with much heavier weight loads, when longer rest periods were provided.

3. *Exhaustion Bouts.* — During the last week of the experiment, a preliminary excursion into the effect of exhaustion bouts upon the precision of ergographic testing was made. The testing procedures effective in step two above were utilized, with the following exceptions: the load placed on the ergograph carriage was a three-eights proportion of each subject's elbow flexion strength; and the subjects continued to exercsie until an exhaustion state was reached. Exhaustion in this study was determined as that point where the forearm movement possible for the subject was so slight that movement of the ergograph distance meter stopped.

The coefficient of correlation between the two exhaustion bouts was .78. Such factors as the following may be the cause for this relatively low precision index:

a. The competitive drive of the subjects may have varied. In precision testing, however, it may be argued that comparable amounts for this element should be evident in each of the two test bouts for the same subject. Two very unusual cases, who simply would not be "beaten by the machine," were encountered. They continued exercising for forty minutes, despite extreme discomfort, until finally stopped by the testers.

b. Despite the improved bracing provided for the subject in this research, nevertheless, additional stabilization of the shoulder is needed in exhaustion testing. Under extreme stress, there was a definite tendency to substitute, in part at least, shoulder movements for the required elbow movements.

c. Unfortunately, there were insufficient weights available for use with the ergograph to permit greater than three-eighth loads with the subjects participating in this experiment. Perhaps there would have been some advantage to utilizing still heavier loads so that exhaustion states could have been reached sooner.

d. Probably, too, the fatigue effect of the first exhaustion bout on the second was pronounced, and that a longer rest period should have been provided. Possibly, precision data for such testing should be taken on separate days.

Time allowed for this experiment did not permit an investigation of these possibilities. Consequently, the further regulation of testing procedures so that precise results may be obtained from exhaustion bouts needs additional study. The objectivity coefficient of 0.78, however, is sufficiently high to render encouragement to the belief that precision procedures might eventually be achieved.

Summary

This research was undertaken to determine the precision with which ergographic testing of the elbow flexion muscles can be accomplished under the conditions described. The subjects were thirty-one male students at Springfield College, who were majoring in physical education and active in athletics; in terms of body weight for height, somatotype, and basic strength, they were superior to college students in general.

The Kelso ergograph was the instrument utilized in muscular fatigue testing. The following results were obtained:

1. A high degree of precision was obtained under conditions of mild to moderate muscular fatigue. This result was true whether the test bouts were administered ten minutes or one week apart, provided the ergograph weight load remained the same.
2. Any length lever arm may be used with consistent results. However, under conditions of mild to moderate muscular fatigue, they must not be interchanged if a comparison of total work done is to be made.
3. The effect of practice upon the results of ergographic testing was slight when muscular fatigue did not reach exhaustion states.
4. Precision in ergographic testing was maintained when weight loads were increased, provided thirty minute rest periods between test bouts were allowed and the fatigue induced fell short of exhaustion.
5. The precision of ergographic testing was reduced when exhaustion states were reached, with a thirty minute rest period between bouts. The objectivity coefficient of 0.78, however, is sufficiently high to render encouragement to the belief that precision procedures might eventually be achieved.

Acknowledgements — This investigation was conducted under auspices of the Office of Naval Research. Acknowledgements are made to Theodore L. Bailey, research laboratory supervisor, and the following graduate students in physical education at Springfield College, who assisted in the collection of test data: Arthur C. Bridgman; Robert W. Lurch, and Arthur E. Williams. Appreciation is also expressed to Professor L. E. A. Kelso, University of Wisconsin, for the construction of the ergograph; and, to Dr. Frances A. Hellebrandt, M.D., Medical College of Virginia, for advice and instruction in the use of the ergograph.

Discussion

Dr. Ben L. Boynton (Houston, Texas): I feel this is really a very fine presentation. It has brought out the very point that was made in a paper yesterday by Dr. Jung, to the effect that test techniques, regardless of whether it is a therapeutic device or an experimental device, such as Dr. Clarke has, should be studied for their validity.

After a very brief discussion with Dr. Clarke, I do not know about the clinical application of this material. Of course, that is where my particular interest lies. However, I can see that this type of testing will develop increasing knowledge on our part and on the part of other investigators, increasing our knowledge of muscle physiology, which knowledge is badly needed.

I don't think anybody really knows the function of skeletal muscle — the physiology of skeletal muscle — to the extent he ought to know it. This paper seems to be a very sound approach, and one will be interested in further studies.

THE USE OF CORTISONE IN THE MANAGEMENT OF THE SHOULDER-HAND SYNDROME

A Case Report

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Until recent times the reflex dystrophy now known as the shoulder-hand syndrome was but infrequently recognized. Furthermore, when the diagnosis was made both physician and patient were invariably taxed by its refractoriness to treatment.

Although the syndrome is initiated by many different causes, the underlying neurovascular mechanism is probably the same. It is the opinion of Steinbrocker, Spitzer, and Friedman,[1] that this phenomenon is initiated from an area of local tissue disturbance, such as a traumatized extremity, a myocardial infarct or an area of cerebral pathology, any site of external or internal disturbance to tissue.

Thus, impulses from these areas move centrally along the conventional afferent pathways and down the internuncial system of neurons within the spinal cord. This is an interconnected and widely ramified network of neurons and nerve fibers within the central nervous system. Ordinarily, incoming nerve impulses travel along the specific pathways of this network to reach predetermined efferent neurons. In the shoulder-hand syndrome the incoming impulses may set up a central disturbance in the nature of a widespread, continuous bombardment of the internuncial pool. Impulses spread steadily to stimulate anterior horn and lateral horn cells not usually affected by afferent impulses from the various lesions. This constant stimulation is manifested peripherally by motor and neurovascular symptoms. In such a manner the resulting muscular spasm and vasomotor imbalance produce the characteristic clinical picture of the shoulder-hand syndrome.[2-3] This concept is now accepted as the most reasonable explanation of the shoulder-hand syndrome no matter what the cause may be for a given case.

In the past this condition was treated primarily with various physiotherapeutic modalities, resulting in some temporary relief with little or no alteration in the course of the pathological physiology. Roentgen therapy also proved inadequate. Interruption of the sympathetic nerve pathways has been reported as giving good results. Recently several[4-5] have noted the use of a local block, by infiltrating the stellate ganglion with procaine hydrochloride, as a successful therapeutic approach. It is their belief that this procedure interrupts the cyclical phenomenon set up through the internuncial pool of active stimuli in the cord by the primary etiological condition; they found that the majority of cases obtained relief of pain, muscle spasm, and disability.

It is the purpose of this paper to present a case that has been refractory

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1. Steinbrocker, O.; Spitzer, N., and Friedman, H. H.: The Shoulder-Hand Syndrome in Reflex Dystrophy of the Upper Extremity, Ann. Int. Med. 29:22 (July) 1948.
2. Steinbrocker, O.; Spitzer, N., and Friedman, H. H.: The Treatment of the Shoulder-Hand Syndrome, Anesthesia and Analgesia 273-278, September-October, 1948.
3. Steinbrocker, O.; Spitzer, N., and Friedman, H. H.: The Shoulder-Hand Syndrome in Reflex Dystrophy of the Upper Extremity, Postgrad. Med. p. 39, May, 1948.
4. Swan, D. M., and McGowan, J. M.: Shoulder-Hand Syndrome Following Myocardial Infarction, J. A. M. A. 146:774 (June 30) 1951.
5. Chitwood, W. R.: The Shoulder-Hand Syndrome Complicating Myocardial Infarction, South. M. J. 44:72.

to physiotherapy, nerve block, roentgen therapy, and stellate ganglion block, but exhibited striking improvement with cortisone.

Report of Case

Mrs. R. R., aged 71, was first seen May 18, 1950, as a follow-up of a healed posterior *myocardial infarct and diabetes mellitus. At this time her complaints* consisted of fatiguability, exhaustion on walking, insomnia and nocturia, recurring episodes of substernal distress, and tightness in the chest. The laboratory findings were as follows: Blood sugar 185 Mg. per cent; Hb 13.5 Gm.; RBC 3,840,000; WBC 7,350; urine, negative for albumin and positive for sugar; blood pressure, 116/70; pulse, 78. The electrocardiographic findings were consistent with an old post-myocardial infarct. Chest film showed the heart to be in a horizontal position with some enlargement.

She was kept pretty well controlled except for tiring easily until January 18, 1951, when there was a rapid onset of a left sided hemiplegia, flaccid paralysis of her left cheek, and inability to raise left eyelid, plus thickened speech. Within twenty-four hours there as a return of voluntary control in both left arm and leg and at least 50 per cent return of eyelid function. The cheek remained about the same. Her recuperative period was relatively short and the only residuum was a slight facial lag.

Her general condition was fairly good and the diabetes well controlled until March 9, 1951, when she experienced an ache in her left shoulder with limitation of motion because of increased pain. This became rapidly worse and in about 7 to 10 days the hand and wrist were swollen, all wrinkles were obliterated, and the skin had a dusky cyanotic appearance. Movement of fingers, hand, and wrist became very painful. Associated symptoms were anorexia, cardiospasm, weakness and marked fatiguability Her discomfort was so great that codeine grs. ½ or meperidine hydrochloride (Demerol® hydrochloride) 50 mgs. every three hours had to be used in order to curtail the pain.

There was no physical or roentgen evidence of rheumatoid arthritis.

Treatment consisted of such physiotherapeutic procedures as paraffin baths, infrared therapy, and passive exercise. When these proved ineffective she was given several nerve blocks plus local infiltration of trigger points, but relief was evanescent. To supplement this, stellate ganglion blocks were done but with no change in the clinical picture.

On June 19, 1951, she was given 100 mg. of cortisone daily by mouth. Within forty-eight hours improvement began. The pain subsided sufficiently so that all narcotics were discontinued and a comfort level was achieved with five grains of acetylsalicylic acid every three to four hours. After one week the swelling of her fingers, hand, and wrist subsided considerably, and movement increased. The shoulder's range of motion was increased, without pain.

Additional salutory effects were increased appetite, disappearance of the mental depression and the constant feeling of fatigue. Consistently with other diabetics who have used cortisone, her blood sugar became elevated and glycosuria appeared. This phenomenon was controlled by simply increasing her insulin dosage.

After ten days of cortisone therapy, using 100 mg. daily the dose was gradually reduced until it was finally discontinued.

Conclusion

Although the mechanism by which cortisone acts is still open to conjecture, its therapeutic effectiveness has been demonstrated in an ever-increasing spectrum of disease entities. Thus, as is illustrated by the above case, this steroid is recommended in the management of the shoulder-hand syndrome for the following reasons: (1) Its analgesic effect. (2) Resultant increased sense of well-being. (3) Increased amenability to adjunctive physiotherapy. (4) Progressive reversal of the existing pathological state.

ETHYL CHLORIDE SPRAY FOR PAINFUL MUSCLE SPASM [*]

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NEW YORK

About sixteen years ago Hans Kraus[1] described the use of ethyl chloride spray for lasting relief of "painful motion." Since then its surprising efficacy in skeletal muscle spasm and other painful states has been confirmed by at least 13 investigators,[2-14] besides ourselves.[15-26] It is interesting that as long as fifty years ago this agent, sprayed briefly on the ear drum, was found to stop the pain of acute otitis media.[27]

Since we became interested in this subject, many physicians have told us of the "miraculous" relief which they obtain at times with ethyl chloride spray in the pain syndromes characterized by muscular spasm, whereas others have told us that in their hands this procedure is relatively, or wholly ineffective. The purpose of this paper is to explain these differences, to indicate the limitations of the method and to set forth certain concepts which we believe are the basis of success with this form of therapy.

Our conclusions are drawn from the study of many hundreds of patients with musculoskeletal pain due to a wide variety of causes. The initial impetus to this work derived from an interest in physical medicine, and dates back many years.[28-30] It is therefore fitting to present our observations on ethyl chloride spray, in this connection a physical agent in a pharmacologic package.

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[*] Read at the Twenty-Ninth Annual Session of the American Congress of Physical Medicine, Denver, Colorado, September 6, 1951.

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In the series of patients treated by ethyl chloride spray, the majority had painful muscle spasm due either to sudden trauma, chronic repetitive strain or protracted chilling, without abnormal neurologic findings and without bone or joint pathology. The syndromes include such disorders as stiff neck, trismus, lumbago, sciatica, painful knees, chronic ankle pain, heel pain, tennis elbow, and the ubiquitous painful shoulder. Predisposing factors in these cases appeared to be acute and chronic respiratory infections, a low basal metabolic rate, general fatigue and anxiety tension states. Some patients had obvious skeletal pathology, such as acute sprains of the ankle, knee, wrist or thumb, osteoarthritis of the spine or of single joints, or fractures. A few had herniated intervertebral disc syndromes with neurologic changes. One had painful calf muscle spasm following acute anterior poliomyelitis. We should also mention a group of patients with painful muscle spasm secondary to acute visceral disease (visceromotor reflexes), for example, the frozen shoulder syndrome which often follows an acute myocardial infarction.

Pain Reference and Site of Application

In almost all these patients, definite "trigger areas" were identified in the affected myofascial structures. A trigger area may be defined as a localized spot of deep hypersensitivity, from which impulses bombard the central nervous system and give rise to referred pain. This implies that the place where the patient feels pain and the place where the pain originates are not usually the same. In this dilemma the most useful fact is that a trigger area at a particular spot gives rise to a distribution of referred pain in one person similar to that occasioned in another. In visceral disease, once the distribution of referred pain has been mapped and learned for a given viscus, the pain pattern then becomes a guide to the origin of pain. This principle also applies to pain reference from the myofascial structures. A known reference pattern may be used to locate the skeletal muscle that is the source of pain.

These concepts are basic to the proper application of ethyl chloride spray for relief of painful muscle spasm. One must distinguish between the site of pain (the reference zone) and the source of pain (the trigger area). For example, painful motion of the ankle in the absence of any signs of joint injury is frequently due to trigger areas located high in the leg in the tibialis anticus

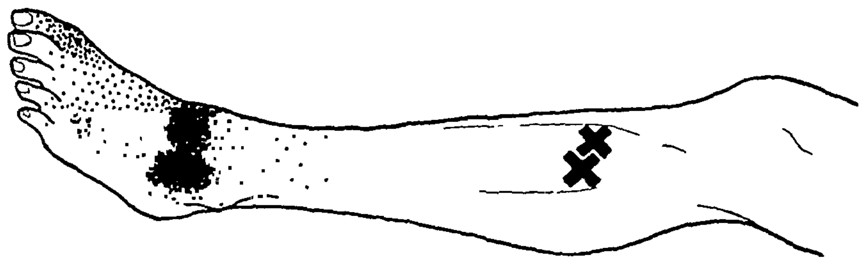

Fig. 1. — Sources of pain at trigger areas XX noted in about 60 patients with ankle pain. Stippling shows distribution of referred pain elicited by pressure at XX. Medial trigger area is located in the tibialis anticus muscle, and refers pain chiefly to front of ankle and big toe. Lateral trigger area is located in the extensor digitorum longus muscle, and refers pain more laterally in ankle and to dorsum of foot over fourth metatarsal bone.

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[28] Travell, W., and Travell, J.: Modifications and Effects of the Static Surge and of the Static Wire-brush Discharge, Arch. Phys. Ther. 12:486, 1941.

[29] Travell, W., and Travell, J.: Technique for Reduction and Ambulatory Treatment of Sacroiliac Displacement, Arch. Phys. Ther. 23:222, 1942.

[30] Travell, J., and Travell, W.: Therapy of Low Back Pain by Manipulation and of Referred Pain in the Lower Extremity by Procaine Infiltration, Arch. Phys. Med. 27:537, 1946.

and extensor digitorum longus muscles (figure 1). The trigger area may be identified as a source of pain when firm sustained pressure on it sets off or aggravates pain in the ankle. In this case, spraying the reference zone, the front of the ankle where the patient complains of pain, relieves pain only momentarily. Spraying the skin overlying the trigger area may abolish pain, restriction of motion and deep tenderness in the reference zone for long periods of time, even permanently. This may be shown by spraying target and trigger areas successively, the order being reversed in different patients.

In most painful shoulder syndromes, we have found that the major source of pain in the front of the shoulder is the infraspinatus muscle. Trigger areas in this muscle may be conveniently employed to demonstrate this difference in the effect of the spray on the site and the source of pain, since their location on the back of the scapula is widely separated from their characteristic zone of pain reference in the anterior deltoid region.[19, 26, 31, 32] However, a trigger mechanism sometimes develops in the most anterior part of the deltoid muscle, with pain referred laterally to the subdeltoid bursa, and may give rise to misleading results in this demonstration. It must be kept in mind that not all trigger areas are widely removed from their reference zones; the reference of pain may at times even circumscribe the trigger area.

Mechanism of Action and Mode of Application

Because of its refrigerant properties, ethyl chloride spray has been used for years as a local anesthetic. It is only natural, therefore, that most investigators have regarded the spray in this light and have applied it heavily, as close to the point of freezing the skin as would escape serious tissue damage.

When we started using this agent, we were amazed to discover that one or two brief passages of the spray over a trigger area might cause its immediate and lasting disappearance. The degree of cooling produced did not result in local anesthesia of the skin, yet pain was completely relieved. This was observed not only in the acute joint sprain (baseball finger, ankle sprain), in acute muscle spasm precipitated by minor injury (painful shoulder) or by fatigue plus chilling (stiff neck), but also in the chest pain of a fresh myocardial infarct. On the other hand, excessive cooling by the spray was likely to intensify pain due to muscle spasm and to increase the limitation of motion.

The immediate nature of the relief afforded by the spray implies interruption of a reversible neurogenic process responsible for maintaining pain and spasm. But if the interruption is not due to local anesthesia, what then is the mechanism by which ethyl chloride spray blocks myofascial trigger areas? When used for this purpose, this agent should probably be regarded as a form of counter-irritation. Counter-irritants applied to the skin have been shown by Gammon and Starr[33] to relieve experimentally induced deep pain by virtue of neurogenic effects mediated through the central nervous system. Their action could not be attributed to reflex changes in blood flow to the deeper structures, since similar relief of pain occurred while the circulation to the region was completely occluded. We[20] found likewise that deep pain produced by ischemic muscle contraction was relieved by ethyl chloride spray during a rest period in which the ischemia was maintained.

Gammon and Starr[33] reported further that intermittent cold was the most effective of the counter-irritants tested. It relieved pain better than continu-

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[31] Travell, J.; Rinzler, S. H., and Herman, M.: Pain and Disability of the Shoulder and Arm. Treatment by Intramuscular Infiltration with Procaine Hydrochloride, J. A. M. A. 120:417, 1942.

[32] Kellgren, J. H.: On the Distribution of Pain Arising from Deep Somatic Structures with Charts of Segmental Pain Areas, Clin. Sc. 4:35, 1939.

[33] Gammon, G. D., and Starr, I., Jr.: Studies on the Relief of Pain by Counter-irritation, J. Clin. Investig. 20:13, 1941.

ous cold did; relief occurred both with the application and the withdrawal of the counter-irritant. The intensity of the cold, or other stimulus applied to the skin, which blocked perception of deep pain had to be close to that which of itself produced pain. Thus, the first effect of a counter-irritant is to initiate, not to block stimuli.

Cattell and Hoagland[34] showed that an interrupted puff of air applied to the frog's skin in a certain manner would produce adaptation, the development at the receptors of a refractory state with respect to a previously effective stimulus. The rhythm of stimulation and the angle which the air jet made with the skin influenced the speed of adaptation. These experimental studies suggest at least two important features of the mechanism of action of ethyl chloride spray, as we employ it: intermittency of cold and intermittency of touch.

Possibly ethyl chloride spray is especially effective because it combines (1) intense stimulation by the cold shock and a rapid rate of change in skin temperature with (2) some degree of direct depression of cutaneous receptors by cooling, and (3) effects analagous to those of light stroking massage.

Procedure

By trial and error we found that the procedure described below is most agreeable to the patient and most effective in relieving painful muscle spasm. The concept of the spray as a counter-irritant makes each detail of the method of its application important, whereas these niceties of technique would have no meaning were the mechanism solely one of local anesthesia.

In the first place, one should use a container of ethyl chloride with a calibrated nozzle* which delivers a moderately fine jet stream. The jet stream should have sufficient force to carry in the air for a distance of at least 3 feet. A mist-like spray is less desirable.

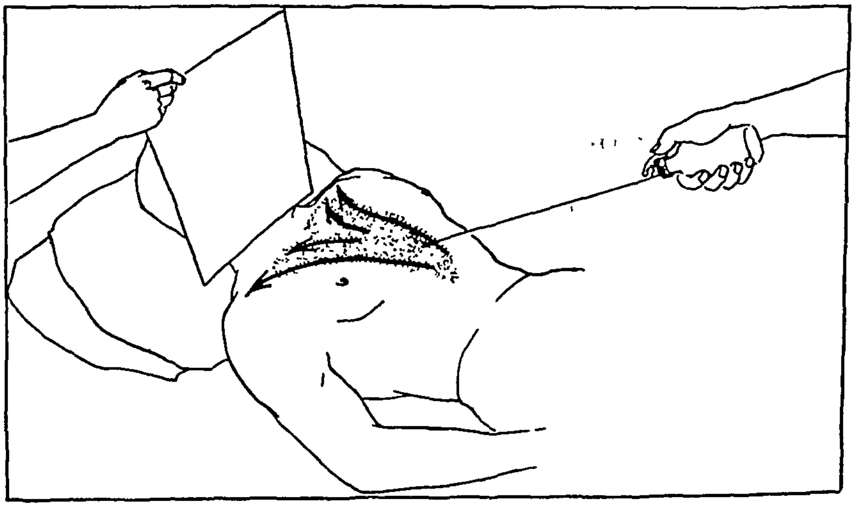

Fig. 2. — Procedure for spraying chest with ethyl chloride in cardiac pain when myofascial trigger areas are present on face of sternum and in parasternal regions: Note that patient's head is raised above level sprayed and face is shielded; container is held about 2 feet away; jet stream meets body surface at acute angle; stream starts at trigger area and moves outward over reference zone; spray is applied in one direction with a sweeping motion. Stretching of chest muscles is accomplished by having patient take a deep breath occasionally, between sweeps.

Before spraying is begun, a check is made to eliminate fire hazards, since this material is inflammable and in certain concentrations with air, explosive.

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[34] Cattell, McK., and Hoagland, H.: Response of Tactile Receptors to Intermittent Stimulation, J. Physiol. 72:392, 1931.

* *The container supplied by the Gebauer Chemical Co. meets these criteria.*

The patient is comfortably supported to promote muscular relaxation (figure 2). The patient's head must be higher than the region to be sprayed and the face shielded to avoid inhalation of ethyl chloride (the vapor is heavy).

The container is held about 2 feet away, in such a manner that the jet stream meets the body surface at an acute angle or at a tangent, not perpendicularly. This lessens the shock of the impact. For the same reason, the stream is sometimes started in the air or on the operator's hand and is gradually brought into contact with the skin overlying the trigger area.

The stream is applied in one direction, not back and forth. Each sweep is started at the trigger area and is moved slowly and evenly outward over the reference zone. Probably it is advantageous to spray both trigger and reference areas, since secondary trigger areas are likely to develop within reference zones when pain is intense.

The optimum speed of transit of the sweep over the skin seems to be about 4 inches per second.

Sweeps are repeated in a rhythm of a few seconds on and a few seconds off, until all of the skin over trigger and reference areas has been covered once or twice. If aching or "cold pain" develops, or if the application of the spray sets off a reference of pain, the interval between sweeps is lengthened. Care is taken not to frost the skin.

During the sweeps, appropriate passive assisted motion is employed to stretch gently the muscle containing the trigger area. Steady gentle stretching is usually essential to a satisfactory result. For example, spasm of the masseter muscle may not be released until it is placed on a passive stretch by a cork wedged between the teeth while the spray is being applied to the side of the face. As relaxation occurs, continued stretch is maintained by inserting increasingly larger corks.

After each series of sweeps, action motion is tested; the patient is asked to move in the directions which were restricted before spraying was begun. An attempt is made to restore the full range of motion, but always within the limits of pain, since sudden over-stretching increases existing muscle spasm. At the same time, precautions are taken not to load heavily the muscles under treatment, either then or during the next few days.

The treatment is continued in this manner until the trigger areas (several are usually present) and their respective pain reference zones have been sprayed. The entire procedure may occupy 15 or 20 minutes, and can not be carried out properly in a hurry. However, after spraying the first trigger area for a minute or two and testing it for changes in sensitivity to pressure, one can usually predict whether a successful result will be obtained with the spray.

Simple exercises which utilize the principle of passive stretch are outlined to the patient, to be carried out a few times daily.

The importance of reestablishing normal motion in conjunction with the use of ethyl chloride spray was emphasized long ago by Kraus.[1] It may be that brief interruption by the spray of the stream of pain impulses is not enough, but in addition, as suggested by Gerard,[35] the input of normal impulses must be fully reinstated.

Clinical Results

About 150 patients with the clinical syndromes described were treated by ethyl chloride spray alone, and a much larger number by the spray in combination with procaine infiltration of trigger areas.

The therapeutic response of acute painful muscle spasm to this method of treatment is illustrated in figure 3. This shows that in 40 patients with acute "stiff neck" due to a variety of causes,[21] application of the spray was followed by complete, permanent relief of pain and stiffness in 70 per cent

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[35] Gerard, R. W.: The Physiology of Pain: Abnormal Neuron States in Causalgia and Related Phenomena, Anesthesiology 12:1, 1951.

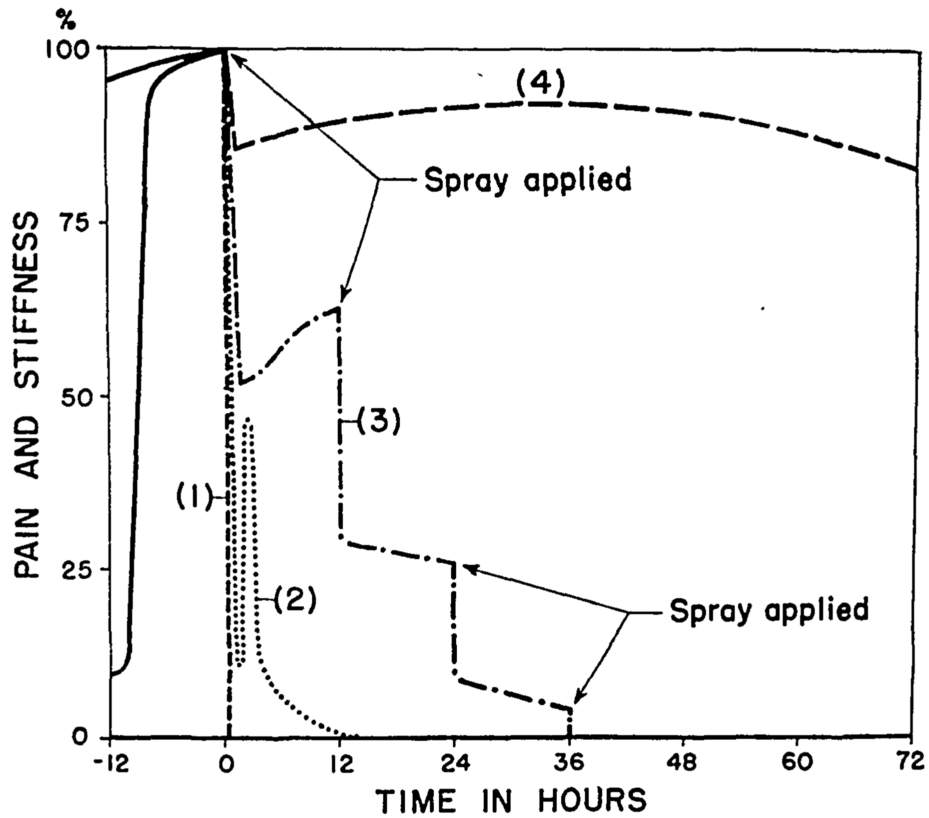

Fig. 3. — Types of clinical responses to ethyl chloride spray in 40 cases of acute stiff neck. Pain and stiffness were taken as 100 per cent at time spray was first applied. Curves 1 (— — —) and 2 (.........), relief total at once, or almost at once (28 cases). Curve 3 (— . —), relief step-like with repeated spraying (10 cases). Curve 4 (— — —), relief negligible (2 cases).

of the cases. In some of these (curve 1), total relief occurred at once, and in some (curve 2), there was marked immediate relief, then a partial recrudescence of symptoms with complete subsidence within a few hours. In 25 per cent of the cases (curve 3), a step-like improvement in painful motion was noted after repeated applications of the spray, with return to normal within 48 hours. In 5 per cent (curve 4), relief was negligible after the first spraying; it was not repeated. Among the last two groups, there were several patients who gave a history of previous attacks of acute stiff neck, with persistence of soreness in the neck muscles between attacks.

Most patients with this disorder undoubtedly recover within a week or two without any treatment other than local heat and aspirin. However, some of these go on to chronic pain and stiffness which last for months and years. Certainly the course of the acute syndrome is shortened, if not terminated at once, by the early application of ethyl chloride spray. In addition, it seems likely that the longstanding sequellae and the persistence of latent trigger mechanisms[26] may be prevented to a large extent by prompt mobilization of the neck.

The types and incidences of responses shown in figure 3 for the acute stiff neck are typical of most acute pain syndromes of skeletal muscle and joints. However, certain muscle groups seem to respond poorly to the spray, notably the iliopsoas, the scaleni and the muscles of the elbow. Possibly the attachments of these muscles are so located that they cannot be stretched adequately during spraying.

The chronic myofascial pain syndromes respond less often to the application of ethyl chloride spray than do the acute ones. When the spray fails, many cases may then be treated successfully by procaine infiltration of trigger areas. This suggests that what is pure neurophysiologic disorder at the outset, with the passage of time develops organic changes that are benefited by the mechanical effects of needling the trigger areas, but not by the reflex effects of spraying the skin with ethyl chloride.

Some important exceptions have been noted to the general rule that chronicity precludes an excellent result with the spray. Dramatic relief of painful motion may occur even years after onset. For example, in the patint who had constant calf pain and had limped for eighteen months following acute anterior poliomyelitis, one treatment with ethyl chloride spray immediately and permanently abolished these symptoms (follow-up: one year). In this adult patient, there was no structural deformity, only slight limitation of dorsiflexion at the ankle; thus adequate stretching of the calf muscles could be carried out during spraying.

Chronic pain at an old fracture site, especially aching with weather changes, may be permanently abolished by a few applications of the spray. This agent may also be useful in recent fractures to secure rapid mobilization on removal of a plaster cast. Stiffness and pain which at times persist inexplicably after surgical removal of a herniated intervertebral disc, may be relieved by ethyl chloride spray, although this agent has not proved helpful in the acute disc syndrome.

Similarly, the persistent somatic pain syndrome initiated by an acute visceral lesion may respond dramatically and permanently to this method of treatment[15-16] if the acute pathologic process in the viscus has ceased and the secondary myofascial trigger areas have become independent of the original source of noxious impulses. For example, pain following a single insult to the heart (myocardial infarct) is more readily controlled by therapy directed at the myofascial arc than is the pain that depends on recurrent cardiac ischemia due to relative coronary insufficiency (effort angina).

Even if only temporary relief of pain is obtained by ethyl chloride spray, this of itself is an important therapeutic achievement under many circumstances. It is helpful to know that the nocturnal "growing pains" of children following strenuous exercise may be temporarily relieved in this manner. In osteoarthritis of the hip joint, instantaneous relief of nocturnal referred pain has been obtained by the patient's applying the spray briefly whenever necessary during the night.

We shall list the reasons which we believe explain many of the failures to obtain a satisfactory result, that is, lasting relief of painful muscle spasm, by means of ethyl chloride spray:

(1) Wrong site of application (pain reference area).
(2) Errors in technique of application, especially excessive cooling and hurrying the procedure.
(3) Lack of attention both to passive stretch and to active motion of the affected muscles.
(4) Presence of mechanical deformities and structural defects which make it impossible to achieve a normal range of motion.
(5) Failure to repeat spraying when partial relief is obtained by the first treatment.
(6) Chronicity of the syndrome and a change in the mechanism of pain.
(7) A continuing remote source of noxious impulses, which may reactivate the myofascial trigger mechanism.

(8) A primary psychogenic etiology of pain, which again supplies a constant source of noxious impulses.

Summary

Ethyl chloride spray is at times extraordinarily effective not only in acute myofascial pain but also in acute visceral pain. Hence, it cannot be inferred a priori that relief of pain by this agent precludes a diagnosis of remote disease, such as a fresh myocardial infarct, an oesophageal hiatus hernia or a twisted ovarian cyst. Longstanding pain syndromes do not respond to the spray as often as do acute ones. A plea is made, therefore, for an early trial with this relatively safe remedy.

Effective application of ethyl chloride spray for relief of painful muscle spasm is not the simple procedure that it appears. Successful therapy with this agent depends on (1) a recognition of the pain reference patterns of the skeletal muscles, (2) knowledge of the anatomy and function of individual muscles and groups of muscles, (3) skill in executing a precise technique and (4) ability to get the patient to relax adequately during the spraying and to cooperate in carrying out active motion at the time of treatment and subsequently.

The mechanism of action of ethyl chloride spray in relieving painful muscle spasm is discussed in relation to methods of its application. This agent probably falls in the category of counter-irritants. A better understanding of the mechanisms involved should remove this important weapon against pain from the realm of empiricism and should enlarge its sphere of usefulness.

Discussion

Dr. H. J. Behrend (New York, N. Y.): We have just heard a most stimulating presentation of a topic which long has been controversial. The trigger point constitutes a diagnostic problem, and its adequate treatment is frequently difficult.

As to the diagnosis, the site of the trigger area may lie within the muscle or in adjacent structures, all being supplied by branches of the autonomic nervous system. Spraying with ethyl chloride constitutes one excellent method of setting up impulses of so-called counter-irritative effects in this cycle.

I wish here to point out the serious pitfall which often militates against the successful treatment of the trigger point. The bombarding nerve impulses which have originated at the trigger point may set up secondary and unobserved trigger points remotely situated. If these are not found and treated, they may send impulses back along the original path and reactivate the primary pattern.

Divergent opinions on the existence of the significance of trigger point should be correlated. There is a basis in fact for most of these opinions, and work such as Dr. Travell has demonstrated is a distinct step in solving this intriguing problem.

We have all enjoyed this excellent presentation brought to us by a true expert in this field.

Dr. William D. Paul (Iowa City, Iowa): We have used this technique for a number of years, particularly on our football team. We have had some excellent results and also some very poor results.

I agree with Dr. Travell that the poor results are caused, first, when we don't spray the trigger area; second, when, with the boy anxious to get back into the game, we try to do it too rapidly, and get the skin too cold. If we find the trigger area and spray it rhythmically and slowly, the results are very good.

We feel it is an excellent adjunct in overcoming painful areas of acute trauma, such as one sees in athletic injuries.

Dr. Janet Travell (New York, N. Y., closing): Dr. Behrend mentioned the autonomic nervous system. I should like to emphasize the fact that there is good evidence that the sympathetic system participates to a large extent in these reflex pain cycles.

As to the secondary trigger areas which he spoke of, they are really very important, and it is interesting to see how you can follow them along in the repeated application of the spray. Let us say you apply the spray to a given area, such as the suprascapular portion of the trapezius muscle in the acute stiff neck syndrome, and you get partial relief of pain. You see the patient the following day and you nearly always find that it is another trigger area that has been left over which is causing the trouble. It may be down in the low portion of the trapezius muscle.

Dr. Paul, thank you for your comments. I would like to emphasize the common sense follow-up management of injuries. This is not all there is to the diagnosis or *treatment of athletic injuries. On the* other hand, a great deal of time and disability can be saved by early application of this method of treatment. It has a large field of usefulness which I believe has hardly been touched by the medical profession.

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.·. EDITORIAL .·.

IS PHYSICAL MEDICINE OVERSOLD?

The rapid expansion of Physical Medicine in this country during the last quarter century has created an unexpected but somewhat anomolous situation. It required the impact of two World Wars to arouse the people of this country and the medical profession to the importance of Physical Medicine and Rehabilitation. Serious attention was not given to the subject until several years after the termination of World War I. At that time, systematic teaching of Physical Medicine in our medical schools was all but non-existent. Few hospitals except some of the larger teaching institutions in medical centers maintained departments of Physical Medicine.

The advent of the Second World War, marked by increased demands for physical forms of treatment and serious shortages of personnel both professional and technical qualified in such procedures, emphasized the shortcomings in this field. From then on, interest in Physical Medicine was stimulated. The end of World War II saw an upsurge in educational activities and an expansion of hospital facilities for Physical Medicine.

Several factors were responsible for this change in attitude towards the teaching and practice of Physical Medicine. Not the least important was the enthusiasm for Physical Medicine developed in hundreds of physicians. Many of these during their service with the Armed Forces, observed for the first time the effectiveness of physical forms of treatment as an adjunct in the management of a wide variety of disabilities. Another powerful influence was exerted by thousands of sick and wounded individuals who learned from personal experience in government hospitals to look upon Physical Medicine as essential to their recovery and rehabilitation. This group demanded, upon their return to civilian life, opportunities to continue the therapeutic procedures upon which they depended. To these factors must be added the growing understanding of the importance of duplicating in our communities the reconditioning and rehabilitation programs that had proved of such value to the Armed Services during the last war. When to these influences there was added the material aid and leadership of such organizations as the Baruch Committee on Physical Medicine and Rehabilitation, the National Foundation for Infantile Paralysis, and other special groups, it is not surprising that this post-war period has seen a veritable renaissance in Physical Medicine.

The outstanding accomplishments of Physical Medicine during recent years are in educational and organizational advances in the field. Medical schools have shown an increased interest in the teaching of Physical Medicine on both an undergraduate and graduate level. Residencies in Physical Medicine and Rehabilitation have been established in federal and non-federal institutions. Hospitals throughout the Nation, at last have become aware of the necessity for Departments of Physical Medicine and Rehabilitation. Moreover, the importance of placing such departments under the direction of qualified physicians is better understood. Community rehabilitation centers have been organized in many parts of the country.

The most significant proof of the progress of Physical Medicine has been its emergence as an accredited medical specialty, evidenced by the formation of the American Board of Physical Medicine and Rehabilitation for the certification of physiatrists and the creation of the Section on Physical Medicine and Rehabilitation of the American Medical Association.

The result of these efforts is that never in the field of Physical Medicine have educational possibilities been so excellent, professional opportunities so many and the demand for qualified physiatrists so great.

The anomolous situation referred to earlier has arisen because in spite of all that has been accomplished and the admitted advantages which a career in Physical Medicine offers, the medical profession as a whole still shows discouragingly little interest in this field. Even more disturbing is the indifference of younger physicians to enter this specialty. Progress in any branch of medicine depends upon constant recruitment of able and interested young individuals. The same applies to Physical Medicine.

The chronic shortage in qualified professional personnel to direct Physical Medicine and Rehabilitation in our hospitals and other institutions has been made more acute by the demands of our Armed Forces arising out of the Korean War. Consequently, hospital managers who, in response to pleas for greater facilities in Physical Medicine have developed departments, now cannot obtain medical personnel for their operation. It has been decreed that curative-workshops, departments of physical and occupational therapy and other groups ancillary to Physical Medicine should operate only under proper medical supervision. To meet such a regulation is impossible when not enough physicians are available.

The situation in connection with residencies and fellowships has become equally discouraging and surprising. In 1943, there were only five approved residencies in Physical Medicine available. Through the interest of hospital boards, educators and certain foundations, the number of approved residencies offered in this specialty on April 1, of this year was 87 — 28 in Federal Institutions and 59 in non-federal hospitals. In addition an undetermined number of research fellowships are available. Last year with the same number of residencies offered not over 50 per cent were filled. An informal survey at this time leads to the conclusion that the number of vacancies for this year will be even greater. In this connection, it is only fair to say this situation is not peculiar to Physical Medicine. During the past year there has been a serious falling off in applications for all types of residencies. There are at present a total of 16,000 residencies available in the United States and it is anticipated that over one-third will be abegging. Present economic trends, but more especially the termination of government subsidies under the so-called "G-I Bill of Rights" may be responsible in part for this situation.

Lack of interest in educational opportunities in Physical Medicine is also apparent from the small enrollment in special graduate courses, long or short, that are offered in this subject. Although, as observed with residencies, attendance upon graduate courses in general is less now than shortly after the last war, the fact remains that applications for courses in Physical Medicine and Rehabilitation fall below those for other specialties.

Thus, we are confronted with an unexpected paradox. Over the years a demand has been created for physical therapy; the need for rehabilitation centers has been popularized; educational opportunities have been improved and expanded numerous residencies and fellowships are offered; Departments of Physical Medicine have been established or are contemplated in many hospitals throughout the land; from all sections of the country come requests for physicians qualified in Physical Medicine and Rehabilitation. Unhappily, enough doctors to meet these demands and to take advantage of the facilities offered are not available. We have created a need — an important legitimate one — which presently the medical profession is unable to fill. The situation is analogous to that of a publicity agent who having created a market for a product finds himself unable to deliver the goods.

The solution of the problem is difficult and complicated. It depends upon our ability to increase significantly and quickly the number of physicians interested in Physical Medicine and Rehabilitation. To do this, the specialty of Physical Medicine must be made more appealing to the younger physicians, must offer better compensation, and greater scientific and professional recognition. Since some of the ways by which this may be brought about have been presented before the last two sessions of the Section on Physical Medicine and Rehabilitation of the American Medical Association, further discussion is superfluous.

Physical Medicine has become a well established accredited medical specialty. It fills a recognized and indispensable therapeutic need. As to its future progress and success, there can be no doubt. It is, however, incumbent upon all who are dedicated to Physical Medicine and Rehabilitation to be realistic about the problems that arise from time to time. Much depends upon how effectively we meet this present shortage of medical personnel. To this end we must put forth our best efforts since the problem must not be underestimated.

MEDICAL NEWS

Members are invited to send to this office items of news of general interest, for example, those relating to society activities, new hospitals, education, etc. Programs should be received at least three weeks before the date of meeting.

Personals

Francis B. Sweeney spoke on "Sensible Use of Physiotherapy in an Industrial Dispensary," at the March meeting of the Philadelphia Interstate Association of Industrial Medicine.

Dr. **Sidney Licht** has been elected a member of the Board of Management of the American Occupational Therapy Association and an Honorary Member of the British Association of Physical Medicine.

Dr. **Howard A. Rusk**, New York, spoke on "What Are We Going to Do About the Chronic Patient," at the American Academy of Neurology Meeting held in Louisville, Ky., in April.

At the annual session of The American College of Physicians held in Cleveland, April 21-25, Dr. **Donald A. Covalt** of New York presented the topic "Rehabilitation of the Hemiplegic."

Dr. **Henry V. Morelewicz**, Cheektowaga, N. Y., recently presented a paper entitled "What Physical Medicine and Rehabilitation Can Contribute to a Research Project on Rheumatoid Arthritis" at the Buffalo Arthritis Society, Buffalo, N. Y.

Bills Introduced

A. 1214 — New York — To amend the physiotherapy law, proposes to authorize applicants for a license to practice physiotherapy to temporarily practice such activities for a period of six months during the pendency of their application for a license.

A. 1647 — New York — To amend the education law, proposes the creation of a state board of physiotherapy examiners.

Arizona, H. 10 — Provides for the creation of a board of physical therapy examiners and defines physical therapy as the treatment of a bodily or mental condition by the use of the physical, chemical or other properties of heat, light, water, or electricity or by massage and active and passive exercise prescribed by a licensed physician but does not include the use of roentgen rays and radium for diagnostic and therapeutic purposes or the use of electricity for surgical purposes, including cauterization.

South Carolina, H. 1760 — Same as above.

Thirty-Eighth Annual Meeting of the Radiological Society of North America, Inc.

Netherland-Plaza Hotel, Cincinnati, Ohio, December 7, 8, 9, 10, 11, and 12, 1952.

Netherland-Plaza Hotel

Refresher Courses, Sunday, 2-5 p. m. and 7-9 p. m. Monday-Friday, 8:30-10:00 a. m.

Scientific Sessions, Monday-Friday, 10:30 a. m.-12:30 p. m.; 1:30 p. m.-4:30 p. m.

Executive Sessions, Monday, Tuesday, and Thursday, 1:30 p. m.

Scientific Exhibits — Commercial Exhibits — Banquet.

Sheraton-Gibson Hotel

Refresher Courses, Tuesday-Friday, 8:30-10:30 a. m.

Scientific Sessions, Tuesday-Friday, 10:30 a. m.-12:30 p. m.

Grant for Pediatric Education

A grant of $10,000 has been made by the National Foundation for Infantile Paralysis to the American Academy of Pediatrics. It is to be used by the Committee on Medical Education to improve pediatric education, and will enable the committee to hold 10 regional conferences on the subject in 1952.

New York Society Meeting

The New York Society of Physical Medicine held a special meeting on April 2. The subject of the scientific session was, "Rehabilitation of the Injured Hand." Dr. Henry H. Kessler spoke on Prosthetic Surgery; Dr. William Bierman on Physical Measures; Dr. Melvin Goldberg on Industrial Implications.

James P. Kerby

It is with regret that we announce the death on January 26 of Dr. James P. Kerby of Salt Lake City, Utah.

Dr. Kerby has been with the Congress for many years.

Correction

The publishers of the book "The Biology of Human Starvation," by Ancel Keys, Josef Brozek, Austin Henschel, Olaf Mickelsen and Henry Longstreet Taylor, reviewed in the March, 1952, issue, have informed this office that the book, Volumes I and II, is not available in single volumes. It is sold only as a set.

New York Society Officers

The following officers have been elected by the New York Society of Physical Medicine for 1952: Hans J. Behrend, President; Morton Hoberman, Vice-President, and Jerome Weiss, Treasurer. The Executive Committee consists of: Sidney Licht, Chairman; William Bierman; Nila K. Covalt; Hans Kraus; William B. Snow. Madge C. L. McGuinness is Secretary.

Seminar at New York University

The Department of Physical Medicine and Rehabilitation of New York University Post-Graduate Medical School is presenting a seminar on the Rehabilitation of Children. The dates are May 19-23; October 20-24, 1952 and January 19-23 1953. The purpose of the seminar is to present (1) the physical, mental, emotional, social and educational problems of the disabled child; (2) the methods of evaluating extent of disability, and (3) the methods of treatment.

The course is open to all physicians, being of particular interest to pediatricians. It will last one week, Monday through Friday, from 9 A.M. till 5 P.M. The tuition is $30.00 per course.

Applications and requests for additional information may be obtained by writing to Dr. George G. Deaver, Director, Children's Division, Institute of Physical Medicine and Rehabilitation, 400 E. 34th St., New York 16, N. Y.

New Medical Journal

Metabolism, a bi-monthly journal devoted to clinical and experimental metabolism first appeared in January, 1952. Editors are Drs. Samuel Soskin and Fuller Albright. The publication is designed to present to the clinician the practical applications of recent advances in metabolism. It will also attempt to keep the research worker abreast of clinical problems.

Grant for Cerebral Palsied Children

The United Cerebral Palsy of New York City, Inc. has made a grant of $22,000 for a special class to be opened in Public School 85 in the Bronx for cerebral palsied children.

Accepted Devices

Armstrong X-P Explosion Proof Baby Incubator Model 22. — Manufactured by The Gordon Armstrong Company, Inc., 1501 Euclid Ave., Cleveland 15, Ohio, device is used for housing an infant under conditions of regulated temperature, humidity and oxygen flow. The Council on Physical Medicine and Rehabilitation voted to include the apparatus in its accepted list.

Master Fischertherm Diathermy Model 1200. — Manufactured by R. A. Fischer & Company, 517 Commercial St., Glendale 3, Cal., device generates short wave medical diathermy. The Council on Physical Medicine and Rehabilitation voted to include the Fischertherm Model 1200 in its list of accepted apparatus.

Birtcher Challenger Short-Wave Diathermy No. 850. — Manufactured by The Birtcher Corporation, 4371 Valley Blvd., Los Angeles 32, Cal., machine is designed to produce a "tube-generated" current for use both in medical diathermy and in minor electrosurgery. The Council on Physical Medicine and Rehabilitation voted to include the apparatus in its accepted list.

Sacro-Ease Models "R" and "200." — Manufactured by McCarty's, 2024 San Pablo Ave., Oakland, Cal., seating pad offers symptomatic relief when ordered by physicians in certain cases of lumbosacral, sacroiliac, and sciatic discomfort. The Council on Physical Medicine and Rehabilitation voted to include both models of Sacro-Ease in its list of accepted devices.

Edin Electroencephalograph, Model 400A Series. — Manufactured by Edin Company, Inc., 207 Main Street, Worcester 8, Mass., device is used to make direct tracings in ink of the potentials associated with cerebral activity. The Council on Physical Medicine and Rehabilitation voted to include the apparatus in its accepted list.

Offner Electroencephalograph, Type D. — Manufactured by Offner Electronics, Inc., 5320 N. Kedzie Ave., Chicago 25, Ill., ink-writing instrument resembles writing desk which can be moved about on casters. The Council on Physical Medicine and Rehabilitation voted to include the apparatus in its accepted list.

Hydro-Pneumatic Bath. — Manufactured by Jay H. Meseroll, 130 S. 19th St., Philadelphia 3, Pa., device is designed for use with a bath tub in such a way as to agitate and aerate the water. Therapeutic benefits to be anticipated are those recognized for agitated warm baths in general The Council on Physical Medicine and Rehabilitation voted to include the Hydro-Pneumatic Bath in its list of apparatus accepted.

Restorator. — Manufactured by Rudolph J. Boyko, 640 Madison Ave., New York 22, N. Y., device administers active exercise in form of circular alternating movement like that made in pedaling a bicycle. The Council on Physical Medicine and Rehabilitation voted to include the apparatus in its accepted list.

TV Program

A series of television programs was inaugurated in February by the Medical Society of the County of New York. The first presentation was devoted to poliomyelitis and originated in the Institute of Physical Medicine and Rehabilitation of the New York University-Bellevue Medical Center.

Newly Registered Therapists

February 28, 1952

Torre, Anthony Louis, 32 W. 102nd, Shanks Village, N. Y.

March 19, 1952

Lange, Manfred Eberhard, 319 W. 138th St., New York 30, N. Y.

Wellington, Margaret Brackett, 72 Holcomb St., West Haven, Conn.

March 26, 1952

Davey, Mary Ellen, 109 S. Academy St., Janesville, Wis.

March 28, 1952

Bloom, Eleanor Rose, 904 N. 8th St., Camden, N. J.

April 15, 1952

Abood, Philip George, % Bash Elliott, Rt. 5, Marshall, Iowa.

Jones, Terry Bass, 904 Boundry St., Red Oak, Iowa.

Drive for Multiple Sclerosis Funds

The National Multiple Sclerosis Society, 270 Park Ave., New York, N. Y., launched a drive on February 8 for the purpose of raising $425,000 for research and service programs concerning multiple sclerosis.

The money will be spent to continue and expand reseach and further the society's educational and service program among physicians, patients, and the public. It has been estimated that 250,000 persons in the United States have the disease.

The Kappa Delta Award for Research in Orthopaedic Surgery

A prize of $1000.00 donated by the Kappa Delta Sorority may be awarded annually by the American Academy of Orthopaedic Surgeons for the best research related to orthopaedic surgery and performed by an American citizen in the United States. This research must be presented to the Committee on Scientific Investigation of the American Academy of Orthopaedic Surgeons before November 1, 1952. Researchers interested in competing for this prize are requested to secure further information from Dr. Claude N. Lambert, 104 South Michigan Avenue, Chicago 3, Illinois, Chairman of the Award Committee for 1952.

Course in Physical Therapy at Northwestern University to Continue

On October 1, 1952, Northwestern University Medical School announced that the course in physical therapy would be discontinued as of October 1, 1953, due to lack of funds for maintaining it.

Soon after this announcement was made, the Illinois Chapter of the American Physical Therapy Association offered to attempt to secure funds to continue the school for a period of three years. A special committee was appointed to study and plan action regarding this critical problem with Miss Joyce Cairns, Head Physical Therapist of the Evanston Hospital, as Chairman. This committee, with the assistance of the Chapter Advisory Committee: Louis B. Newman, M.D., Chief of Department of Physical Medicine and Rehabilitation, Veterans Administration Hospital, Hines, Illinois; Edward A. Piszczek, Executive Director, Suburban Cook County Tuberculosis Sanitarium District; and George A. Rooney, lawyer, was responsible for interesting the United Cerebral Palsy Association in this problem.

On February 17, 1952, the United Cerebral Palsy Association offered a sum of $12,000 so that the school might continue.

BOOK REVIEWS

FUNCTIONAL NEURO-ANATOMY: Including an Atlas of the Brain Stem. By *A. R. Buchanan,* M.D., Professor of Anatomy, University of Colorado School of Medicine, Denver, Colorado. Second edition, thoroughly revised. Cloth. Price, $7.50. Pp. 323, with 273 illustrations, 19 in color. Lea & Febiger, Washington Square, Philadelphia 6, 1951.

The term "Functional Neuro-anatomy" is used as a title because the method of approach is to describe pathways from beginning to end individually rather than all together from level to level. For example, the sensory system is taken up from the receptors in the periphery through to the cortex. The same arrangement applies to the motor system and other special functions of the nervous system. Brief descriptions of clinical syndromes are used in illustration, thus making the text useful as a reference for the clinician. The majority of the illustrations are diagrammatic drawings so essential in visualizing portions of the nervous system according to function. Histological detail is rather briefly considered.

An atlas of 74 pages has been added in this edition. This is prepared from serial section photographs of the brain stem, one-half of which has been converted to a line drawing to indicate the structural details.

This is an exceptionally excellent neuroanatomy text in all respects including brevity of description consistent with clarity, fine illustrations, satisfactory bibliography and indexing, and attractive printing and binding. It is recommended for use of medical students as a standard text and as a reference for all other students of neurology including physical therapists and physiatrists.

PLASTIC SURGERY OF THE NOSE, Including Reconstruction of War Injuries and of Deformities from Neoplastic, Traumatic, Radiation, Congenital, and Other Causes. By *James Barrett Brown,* M.D., Professor of Clinical Surgery, Washington University School of Medicine, St. Louis, Mo.; Chief Consultant in Plastic Surgery, United States Veterans Administration, Washington, D. C.; Formerly Senior Consultant in Plastic Surgery, United States Army and in E. T. O., and Chief of Plastic Surgery, Valley Forge General Hospital; and *Frank McDowell,* M.D., Assistant Professor of Clinical Surgery, Washington University School of Medicine, St. Louis, Mo. Cloth. Price, $15.00, including 48 in color. Pp. 427, with 379 illustrations. The C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, 1951.

This book is intended for the use of plastic surgeons and undoubtedly all would like to have it in their library. Operative technique and results are beautifully and clearly illustrated by a profusion of photographs and two colored diagrammatic drawings. The basis is the author's own clinical experience which is large and apparently very successful.

The physiatrist may find the book of interest as a reference in cases of rehabilitation, because of the importance of personal appearance in social and economic adjustment.

CONGENITAL DISLOCATION OF THE HIP. By *Julius Hass,* M.D. Cloth. Price, $12.50. Pp. 405, with 134 illustrations. Charles C Thomas, 301-327 E. Lawrence Ave., Springfield, Ill.; Blackwell Scientific Publications, Ltd., 49 Broad St., Oxford, England; Ryerson Press, 299 Queen St., W., Toronto, 2B, 1951.

Congenital dislocation of the hip is, of course, a subject which primarily concerns the orthopedic surgeon. The after-care may require the service of the physiatrist, and consequently the latter as a consultant must be informed on present accepted methods of treatment. He should also be familiar with the pathology, theories of etiology, symptoms, course, and prognosis. This volume brings together a most adequate summary of historical data and our present knowledge of the subject, and includes well reproduced x-rays, photographs, and line drawings so essential for teaching. Although this is an authoritative and well documented text for the orthopedic surgeon, it is lacking in technical details of interest to those in Physical Medicine. For example, we find the statement, "Weakness of the musculature should be combatted by abduction exercises and massage of the gluteal muscles."

Highly recommended for students of orthopedic surgery and as a reference for physiatrists.

HUMAN BIOCHEMISTRY. By *Israel S. Kleiner, Ph D.,* Third edition. Professor of Biochemistry and Director of the Department of Biochemistry, New York Medical College, Flower and Fifth Avenue Hospitals, formerly Associate, The Rockefeller Institute for Medical Research, New York. Cloth. Price, $7.00. Pp. 694, with 83 illustrations. The C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, 1951.

This Third Edition of Human Biochemistry is a revision and enlargement of the previous editions and almost every chapter either includes new material or has been corrected to bring it up to date. The inclusion of as much material as possible in a book of moderate size has necessitated considerable condensation and consequently it is a text more suitable to a survey course than to a more basic course in elementary biochemistry.

The text is supplemented freely with tables, diagrams and structures. In a few cases the structures are misleading and should have been omitted, for example the formaldehyde — amino acid reaction (p. 105).

The chapters that have been most greatly enlarged and revised are those dealing with mineral metabolism, respiration and acid-base balance and Vitamin A function. The book is a well arranged and readable panoramic presentation of biochemistry at an elementary level.

A COURSE IN PRACTICAL THERAPEUTICS. By *Martin Emil Rehfuss*, M.D., F.A.C.P., Professor of Clinical Medicine, The Jefferson Medical College, Philadelphia; and *Alison Howe Price*, M.D., Associate Professor of Medicine, The Jefferson Medical College, Philadelphia. Second edition. Cloth. Price, $15.00. Pp. 950, with 96 plates, 4 in full color. The Williams & Wilkins Company, Mt. Royal and Guilford Aves., Baltimore 2, 1951.

This book now in its second edition is indeed a practical guide in therapeutics for the general practitioner as well as other physicians confronted with treatment problems. The text is so arranged that the first section is basic and concerns general therapeutic principles of inestimable value to the student of medicine. The remaining three sections of the book deal with symptomatic therapy, treatment of specific diseases and special treatments, respectively. The content is that of the latest practical and proven advances in the field of therapeutics. The style of the various contributors, seventeen in number, is especially clear and with numerous well chosen illustrations makes for considerable ease in locating the answer to any therapeutic problem. The publishing is good and the book is recommended for use by general practitioners and other interested students of medicine.

A TEXTBOOK OF MEDICAL CONDITIONS FOR PHYSIOTHERAPISTS. By *Joan E. Cash*, B.A., M.C.S.P. With foreword by *Frank D. Howitt*, C.V.O., M.A., M.D. Cloth. Price, $5.00. Pp. 350, with illustrations. J. B. Lippincott Company, 227-231 S. 6th St., Philadelphia 5; Aldine House, 10-13 Bedford St., London, W.C.2; 2083 Guy St., Montreal, 1951.

This book consists of 350 pages divided into seven parts. Each part covers the following headings in this order: pathological changes, rheumatic affections, diseases of the respiratory system, disorders of the nervous system, diseases of the cardio-vascular system, disorders of abdominal viscera and peritoneum, some common diseases of the skin and its appendages.

The text is written in a lucid style but the material covered is deficient and oversimplified from a medical standpoint.

Treatment by physical medicine methods is outlined very briefly in most cases, but the chapter on respiratory disorders and some parts of the nervous system is covered adequately for physical therapy students.

The illustrations are good, although few in number.

The information presented here will be of value to physical therapy students only on a supplementary basis, and it is of no value to physiatrists or physicians in general.

HEALTH INSTRUCTION YEARBOOK, 1951. Compiled by *Oliver E. Byrd*, Ed.D., M.D., F.A.P.H.A., Professor of Health Education, and Director, Department of Hygiene, School of Education, Stanford University. Foreword by *Bernice Moss*, M.A., Ed.D., President, American Association for Health, Physical Education, and Recreation and Associate Professor of Health Education, University of Utah. *Cloth. Pp. 236. Price, $3.50.* Stanford University Press, Stanford, Calif., 1952.

This is the ninth edition of this popular work which is a digest of some 1500 articles on health and its various problems that were published from July 1, 1950, to June 30, 1951. The following quotation from the foreword sums up the value of such a review — "The number of publications and articles dealing with health which find their way to the desk of the busy teacher or health worker is apt to be somewhat overwhelming. To read them all seems impossible, and not to read them seems to give evidence of lack of professional interest. Dr. Byrd is to be commended for his continuous and painstaking analysis of current health literature and his presentation of important information in highly readable form."

COMMUNITY HEALTH EDUCATION IN ACTION. By *Raymond S. Patterson*, Ph.D., Director of Health Education, John Hancock Mutual Life Insurance Company, Boston, and *Beryl J. Roberts*, Ed.M., M.P.H., Associate in Health Education, Harvard School of Public Health, Boston. Cloth. Price, $4.50. Pp. 346, with illustrations. C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, 1951.

This book defines health education, explains the work of a health educator, describes the kinds of organizations that can be used effectively, discusses in detail the possibilities of various types of propaganda, and finally tells how to find out whether anything has been accomplished. This is done in a lively style that is deceptively readable; not every author can achieve this modern effect of "medium bounce" and still pack his book with so much substantial information. It is gratifying to find (page 256) an acknowledgement of the pioneer work of the Bureau of Health Education of the American Medical Association in the use of television for this purpose. Anyone planning exhibits, making motion pictures, giving public lectures, or writing health columns would do well to read this book from cover to cover. It is attractively illustrated, well indexed, and provided with helpful bibliographic references in the footnotes.

PHYSICAL MEDICINE ABSTRACTS

Errors and Pitfalls in the Diagnosis and Treatment of Rheumatic Diseases. Ezra Lipkin.

J. Michigan M. Soc. 50:1022 (Sept.) 1951.

In this review, the author has attempted to cover some of the highlights of twenty-five years experience with rheumatic disease, with particular stress upon errors from which he, or any other conscientious physician, has not been immune. He has stressed the differential diagnosis between rheumatoid and osteoarthritis generally, rheumatoid and osteoarthritic spondylitis, rheumatoid arthritis and rheumatic fever, rheumatoid arthritis and gout, specific and nonspecific arthritis, the various types of backache and sciatica, and painful shoulder. As for treatment, in rheumatoid arthritis excessive immobilization of the joints may lead to ankylosis; a fine balance, therefore, must be established between rest and activity. In osteoarthritis, rest is desirable, and prolonged exercise usually leads to a recurrence of the symptoms. The use of typhoid vaccine, gold, cortisone and ACTH is worthless in osteoarthritis, although some investigators have reported favorable results in osteoarthritis of the hip with cortisone. Otherwise, the treatment is directed toward rest and support of the affected joint, improvement of the circulation through physical therapy, reduction of weight, the use of analgesics, and so forth.

The most common of all rheumatic afflictions is low backache, which may be due to a multitude of causes: simple back strain — lumbar and sacroiliac — constipation, cystitis, prostatitis, cervicitis, and osteoarthritis. The treatment naturally resolves itself to a discovery of the cause and its correction, whether by appropriate support, laxatives, prostatic massage, electrocautery or shortwave therapy.

Of the patients that consult a physician with single joint afflictions, none is more common than the sufferer from a painful shoulder. The majority of these are periarthritic in origin, and are classified under bursitis. The non-calcified periarthritides are helped by physical therapy and massage with graduated exercise. Should they fail to respond to these measures, resort may be had to brachial block with one per cent procaine.

Cortisone in Rheumatoid Arthritis: An Interval Report. Alvin E. Price; James J. Lightbody; William S. Reveno, and Elmore C. Vonder Heide.

J. Michigan M. Soc. 50:1015 (Sept.) 1951.

This report covers sixty-three cases of rheumatoid arthritis, all of whom have received cortisone for at least three months. All had multiple joint involvement with the duration of illness varying from four months to thirty-six years. Prior to the institution of cortisone therapy, most patients had received a wide variety of treatments with varying response. In most of the patients, physical therapy was used as an adjunct to cortisone during the two-week period of hospitalization. This consisted of baking and massage by trained physical therapists, and in some hydrotherapy in the Hubbard tank was used. The immediate effect of cortisone was favorable in all but two cases. In practically all patients this became apparent about the third day, although in several instances it was noticed sooner. In only two cases was there no change observed at any time during the course of treatment. Improvement noted was subjective as well as objective, with a loss of pain and stiffness as well as a reduction in size of the affected joints.

Diagnosis and Management of Chronic Peripheral Arterial Insufficiency. Harold N. Neu, and William J. Reedy.

J. Iowa M. Soc. 41:413 (Oct.) 1951.

The authors suggest a regime of therapy which they have found quite successful in the conservative management of chronic peripheral arterial insufficiency. It is evident from the literature that no single agent has been uniformly consistent in producing the desirable effect of increased blood flow to the extremities. There are a well-known number of general therapeutic measures which are important. It is quite well agreed that tobacco in any form must be absolutely prohibited for successful results in the management of thromboangiitis obliterans. The use of proper clothing is stressed. The control of infection and of diabetes when present is a basic principle known to everyone who treats peripheral occlusion vascular disorders. The use of bed rest is highly effective in patients who complain of severe pain at rest or during a short walking distance and those with trophic changes such as ulcerations, blebs or gangrene. The environmental temperature is maintained at 85 F. at which temperature maximum vasodilatation seems to occur. Activity in bed is encouraged to avoid the hazards incident to two to three weeks of bed rest. Buerger's exercises as described by him are practiced to improve circulation with the exception that local heat is not applied to the legs while in the resting horizontal position. Neu and Reedy prefer to use reflex heat by means of electric heating pads or hot water bottles to the abdomen. The heating mechanism is maintained during the complete exercise period. The use of heat to the extremities is interdicted because of the practical problems of securing absolutely controlled temperatures. If this could be assured then local measured heat would be acceptable. The vasodilating agents chiefly used by these authors in the past several years have been Priscoline and whiskey, often prescribed concomitantly during the same day. The authors feel that the problem of peripheral arterial insufficiency will become more common, and that the diagnosis of this condition can be made accurately by simple measures in the great majority of instances. Success should not depend upon a single agent for treatment, but emphasis should be upon the employment of a regime of useful measures which can add comfort and perhaps years to the life of the patient.

Immediate Treatment of Hand Injuries. Sumner L. Koch.

Pennsylvania M. J. 54:721 (Aug.) 1951.

The principles of the immediate treatment of injuries of the hand are identical with those of compound injuries elsewhere, and it is those principles which are stressed rather than specific details. They are stated very briefly as follows, and then Doctor Koch gives a brief elaboration on each principle:

Protect the open wound from infection; stop bleeding; determine the extent of injury; transform the contaminated wound into a clean wound; if the latter can be accomplished, bring fractured bone fragments into position, repair the injured structures, and close the wound; if one is uncertain as to the cleanliness of the wound, reduce fractured bone fragments but leave injured tendons and nerves undisturbed, and either leave the wound open or bring wound edges together without tension; cover the entire injured area with a large compression dressing and apply a splint to keep the part at rest.

A few words should be added concerning the later treatment of injuries of the hand, after wound healing is complete. If further surgical treatment is indicated, it should be delayed until inflammatory reaction and deep induration about the site of injury have subsided. If infection develops after the original injury, bacteria will remain viable in the deeper tissues for a number of weeks after wound healing is complete. Inflammatory reaction persists still longer and makes exposure and mobilization of injured structures tedious and difficult. The best results will be secured if secondary operations are delayed until the tissues are as nearly normal as possible. During the waiting period much can be accomplished by simple physical therapy. One of the most helpful procedures available is to have the patient soak the injured hand for 15 or 20 minutes at least twice daily in warm soapy water, massaging it gently with a soft washcloth during the period of soaking, and to have him move the fingers through as wide a range of movement as possible without swelling and pain. To stimulate circulation and so improve the nutrition of the tissues, and to maintain flexibility and increase the range of movement at the small joints of the hand are objectives that should be constantly kept in mind as one awaits the most favorable moment for secondary operation.

Electromyography. Arthur E. White, and James D. Amos.

U. S. Armed Forces M. J. 2:1151 (Aug.) 1951.

Electromyography should be used as an aid to diagnosis only after full and careful clinical evaluation. Without a clear clinical picture in his mind, the physician may often find machines more misleading than useful in any branch of medicine In addition, electromyography should be preceded by muscle testing with a suitable rectangular wave (electrodiagnostic) stimulator because a combination of the procedures gives a much more complete picture than either alone. The use of electromyography presupposes thorough training in the interpretation of data obtained from it, otherwise confusion would result when any but the most elementary action potentials are elicited. Recent observations have shown spontaneous discharges in anterior poliomyelitis to be a striking feature, especially in the convalescent stage when they are a sign of improvement of muscular function. The completely paralyzed muscle is electrically silent except for fibrillations which develop from 16 to 21 days after the onset of poliomyelitis. Muscular spasm is absent during the time of development of paralysis in acute anterior poliomyelitis. There is an increase in irritability to stretching of muscles during the acute stage without any correlation to spasm, tenderness, or pain on stretching. The pattern of electric discharges produced by stretching resembles in appearance that obtained from muscles in a state of tonic contracture or spasm secondary to fracture of an extremity. Hansson and his collaborators found a decrease in the amplitude and number of action potentials in muscles weakened by poliomyelitis. They also found this decrease to be almost proportional to the decrease in muscle power. On this data they offered a method of grading muscle strength with the electromyograph.

Effect of Rapid and Prolonged Rewarming on Local Cold Injury. Josef Pichotka, and Robert B. Lewis.

U. S. Armed Forces M. J. 2:1293 (Sept.) 1951.

The rate of rewarming a frozen limb has a decisive influence upon the clinical result. The general belief is that slow rewarming is most beneficial and that direct application of heat to a frozen area is injurious and therefore should be avoided. This assumption is based upon popular observations that with slow rewarming alarming clinical signs and symptoms, such as marked swelling and severe pain, can best be avoided. However, these observations are uncontrolled, and many of the examples quoted to indicate the danger of rapid rewarming are open to question. In recent years several articles showing that rapid rewarming of frozen parts was not harmful but even beneficial have been published. The most important among these are those of Fuhrman and Crismon and Finneran and Schumacker. These authors showed that rapid rewarming definitely decreased the tissue loss after a standard cold injury. The experiments of Pichotka and Lewis were performed in order to repeat the previous investigations with a method of cold injury which permitted a more exact quantification of the results. They hoped, at the same time, that some insight might be gained which would result in a more clearly differentiating effect of rapid rewarming on frostbitten tissue. These studies showed that rapid thawing of frozen legs in water at 42 C. for five to eight minutes almost entirely prevented cutaneous necrosis after exposure to —12 and —15 C. for thirty minutes. Spontaneous rewarming in air at room temperature after these two standard injuries, in these and previous experiments, resulted in superficial necrosis in 20 and 90 per cent of the cases, respectively. The extent of muscular necrosis was definitely decreased by the rapid thawing, but the results were not so striking as in the case of cutaneous necrosis. Prolonged rewarming with water at 40 C. up to 1 hour gave in all cases the same beneficial influence as rapid thawing for only five to eight minutes. Animals with rapidly rewarmed legs exhibited a better general appearance than animals left to spontaneous rewarming and preserved better function of the injured limbs.

Nylon Arthroplasty in Rheumatoid and Osteo-Arthritis. John G. Kuhns, and Theodore A. Potter.

Ann. Rheumat. Dis. 10:22 (Mar.) 1951.

After operation to form a new knee joint, the leg usually is kept elevated upon pillows for 48 hours. Transfusions of one to two pints of blood usually are given as well as penicillin as prophylactic measures. Muscle-setting exercises are begun before the end of the first week after operation. Active exercises are begun after one week. Movement against gravity is begun as soon as the wound is healed. Weight-bearing with crutches and a plaster cylinder are begun in three weeks unless there is much bony atrophy. Resistance exercises (De Lorme and Watkins, 1948) are given to regain normal strength in the extensor muscles. Six months usually are required to regain normal strength and good function. Arthroplasty of the knee in chronic arthritis is always an operation of election. It does not produce a normal knee joint but usually results in a useful joint with a fairly wide range of painless motion. In operations of this nature the postoperative period is most important, since motion depends upon the avoidance of complications and the early and persistent activity of the patient. The patient must begin motion or muscle-setting procedures within a few days, and active and resistance exercises of increasing strenuousness must be performed after wound-healing to secure good motion and normal strength. In a few patients normal strength and good function have gradually come after a year and a half, but we do not advocate such slow convalescence; adhesions and muscular stiffness can develop too readily. The desideratum after arthroplasty of the knee has changed little in the last 50 years; it is a stable, painless knee with about 60 degrees of motion. In a recent review, Speed and Trout (1949) stated that 70 degrees of motion made for the greatest endurance and stability, but many of our patients have over 90 degrees of motion and all of them are stable and painless. The greater range of motion, we believe, has resulted from the vigorous use of the newer physical therapy techniques, particularly resistance exercises.

Thoracic Injuries in World War II — Part II: Therapy in the Reconstructive Phase. Joseph P. O'Connor.

Armed Forces M. J. 2:1277 (Sept.) 1951.

Three hundred and nine patients requiring late and definitive treatment because of traumatic lesions of the chest wall and lungs were studied. The usual postoperative procedures necessary for patients with thoracic injury were followed for the first 24 to 36 hours after which early ambulation was encouraged and exercises were started. Even patients too obviously ill to be out of bed for weeks were put through organized exercises supervised by the athletic instructors of the physical education and rehabilitation department together with the technicians of the physical therapy section. As soon as the patient could sit up in bed and subsequently became ambulatory his exercises were increased to the point of tolerance under instruction. In all cases of hemothorax and in other wounds of the thorax, atrophy of the pectoral and other muscles of the rib cage was a common finding. In some, the atrophy was striking, the patient presenting on admission a visible deformity in just a few weeks after injury. Therefore, an important part of the immediate treatment became the exercises. The instructors and technicians stepped up the tempo of the physical activity as the clinical condition permitted, to the extent that such strenuous games as volleyball, basketball, and tennis became part of the treatment. Many a young, frightened, and ill patient was admitted with a large hemothorax and one-half of his chest immobilized and apparently "stove-in," only to undergo thoracentesis once or twice and begin immediately with a regimen of exercises and suddenly change into a robust lad on the road to recovery. The reason for this is just as obscure as that for the cases of total hemothorax which cleared without aspiration.

Contents—June, 1952

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ORIGINAL ARTICLES

Mechanism of Absorption of Ultrasonic Energy in Blood. George Morris Piersol, M. D.; Herman P. Schwan, Ph.D.; Robert B. Pennell, Ph.D., and Edwin L. Carstensen, M.S. 327

Prescribed Occupational Therapy. Nila K. Covalt, M.D. 333
Discussed by Drs. Herman Rudolph; Gloria Roth, and Nila K. Covalt.

Ineffectiveness of Ultraviolet Hemo-Irradiation in Distemper. Khalil G. Wakim, M.D.; Frank H. Krusen, M.D.; Carl F. Schlotthauer, D.V.M., and Fordyce R. Heilman, M.D. 339
Discussed by Drs. R. C. Olney; L. F. Valentine; F. Lustig; D. S. Rausten, and K. G. Wakim.

Sex Differences in Registry Examination Performance of Physical Therapists. Clay d'A. Gerken, Ph.D. 345

The Neuropsychiatric Aspects of Rehabilitation. Franklin G. Ebaugh, M.D. 348
Discussed by Drs. George Deaver, and Ben L. Boynton.

Exercises Following the Bankart Operation for Recurrent Shoulder Dislocation. J. D. Rudd, M.D., and E. F. Haydock, R.P.T. 353
Discussed by Drs. W. B. Snow, and J. L. Rudd.

New Developments in Amputee Rehabilitation. Atha Thomas, M.D. 357
Discussed by Dr. O. F. von Werssowetz.

Pathogenetic Concepts of Fibrositis. Irvin Neufeld, M.D. 363

•

Medical News 370

•

Editorial 371

•

Book Reviews 373

•

Physical Medicine Abstracts 375

•

EDITOR OF THE MONTH

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1952

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MECHANISM OF ABSORPTION OF ULTRASONIC ENERGY IN BLOOD *

GEORGE MORRIS PIERSOL, M.D.
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and
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GLENOLDEN, PENNA.

If high frequency sound is to be used as a clinical tool, it is important that we increase our knowledge of the fundamental acoustic properties of the tissue that is to be treated. Accordingly a program has been undertaken which includes the measurement of the absorption and velocity of sound in the various body tissues and blood. The motivation for this work is twofold. First, the data are the basis for a phenomenological description of the heating processes in ultrasonic diathermy. Second, by study of the absorption data for the various tissue components, it is possible to draw conclusions regarding the actual mechanism of the conversion of high frequency mechanical energy into heat.

Two general classes of absorption participate to varying degrees in the losses characteristic of the various tissues. The first will be called volume absorption; this includes those losses characteristic of completely homogeneous liquids and solids, i. e., it may include viscous losses, losses resulting from the conduction of heat, molecular relaxation and elastic hysteresis. The second will be called structural absorption; this includes all those losses resulting from the presence of abrupt interfaces in the tissue. These losses may arise from scattering, multiple reflections, and the development of highly damped shear waves. These shear waves may enter into the heating process as follows: Both shear (transverse) waves as well as compressional (longitudinal) waves can be supported by solid media. Furthermore, when a compressional wave strikes an interface, the reflection may be a complex combination of shear and compressional waves. The shear wave may be expected to decay rapidly, producing localized heating in the region of the interface.

Blood was chosen to begin the investigation because it has properties in common with the body tissues and yet is sufficiently simple and homogeneous that it can be measured with a relatively high degree of accuracy.

Although blood contains small structural units in the form of the blood corpuscles, the measurements of this investigation have shown that the absorption of sound in blood is almost entirely of the volume type.

Experimental Methods

The technique used for the measurement of ultrasonic absorption is in effect a comparison of the properties of a test liquid with those of water.

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* Aided by a grant from the National Foundation for Infantile Paralysis, Inc.

The mechanical arrangement is shown in figure 1. The test vessel here is divided into two compartments by a rubber diaphragm. One-half is filled with water, the other with the liquid under investigation. The transducers are mounted on a sliding assembly, the source in the water chamber, the receiver in the test liquid. By moving this assembly along the axis of the test tank it is possible to substitute arbitrary amounts of test liquid for water in the acoustic path. Measurements of attenuation of the acoustic energy as a function of assembly position then can be used for calculation of the absorption.* Units of absorption used in this paper are decibels per centimeter.† The overall error of the absorption determinations is estimated to be between 0.02 and 0.04 db/cm.

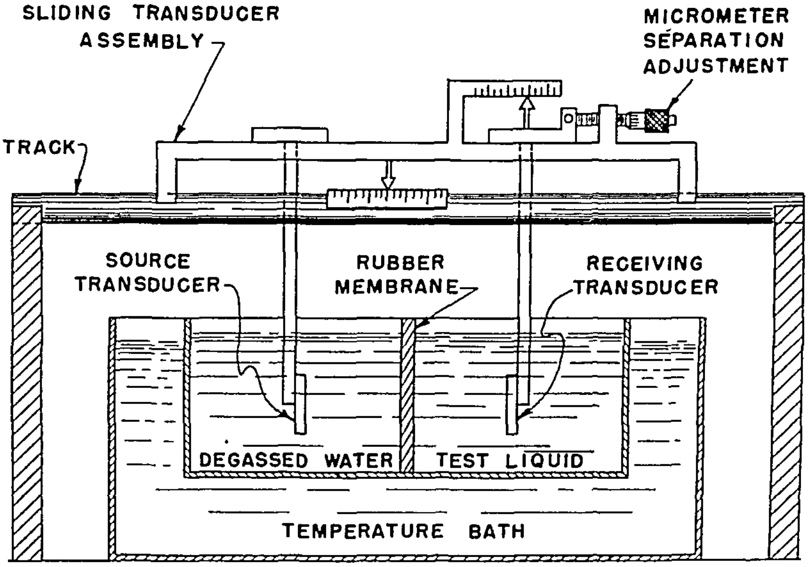

Fig. 1. — Mechanical arrangement for measuring ultrasonic absorption.

Temperature control was maintained by a constant temperature bath which could be regulated to within a few tenths of a degree from 0 to 50 C.

The intensity levels used for these measurements were far below those necessary to produce cavitation (bubble formation resulting from large negative pressures). The actual intensities used ranged from 1 microwatt to 1 milliwatt per square centimeter. Over this range there were no indications of a dependence of the absorption on intensity.

Both water and the test liquid were placed under vacuum for a few minutes before measurement to remove a part of the normally dissolved gases. Both optical density and electrical resistivity measurements were made on blood samples treated by this method to make certain that no red cells were destroyed by the evacuation.

Experimental Results

The absorption of sound in blood was measured as a function of the concentration of red cells, figure 2. The various concentrations were obtained by mixing the cell residue of centrifuged blood with human plasma. The result is a linear dependence of the absorption upon concentration. However, it is apparent that absorption in plasma, although small, is by no means negligible.

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* This method has been described in detail in a paper entitled, "The Acoustic Impedance of Human Blood," presented at the May, 1951, meeting of the Acoustic Society of America.

† The decibel is ten times logarithm to the base 10 of the ratio of the intensities at two points along the acoustic path, e. g., a loss of 3 db signifies a reduction of the intensity to one-half that of the reference level.

Since there are no cells or tissue structure in the plasma, it follows that volume absorption must be considered as at least one of the contributing factors in the total absorption process. Now the absorption of sound in water or physiological saline is negligible compared with that of plasma. Hence, it may be postulated that the protein molecules in solution in the plasma are responsible for its absorption.

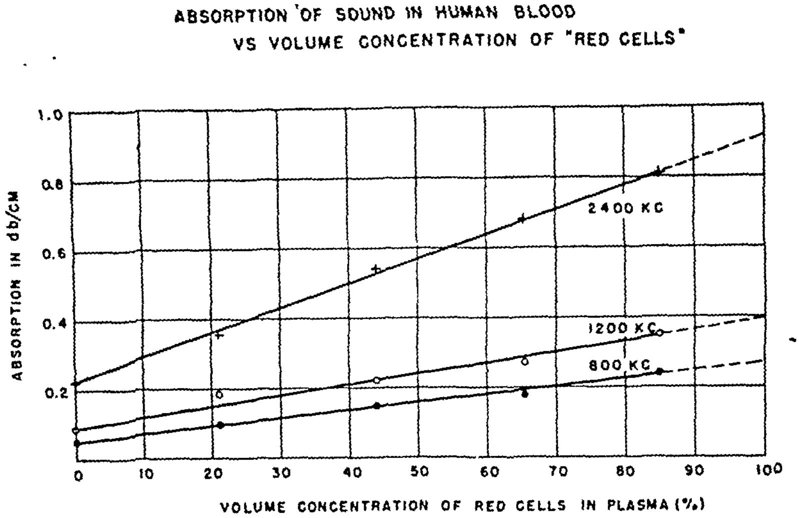

Fig. 2. — Absorption of sound in human blood as a function of volume concentration of red cells.

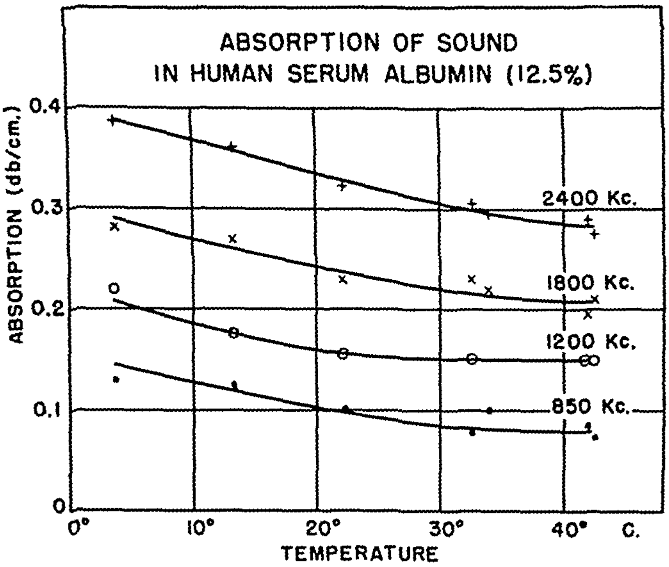

Fig. 3. — Absorption of sound in a 12.5 per cent solution of normal human serum albumin.

Measurements subsequently have been made on the following blood components: concentrated red cells from horse blood, horse plasma, a 7 per cent solution of human hemoglobin[1] containing no stromata, a 12.5 per cent solution of normal human serum albumin, and a suspension of stromata. The stromata were prepared by hemolysing red cells with 10 volumes of water saturated with carbon dioxide and subsequently washing the precipitated stromata by repeated resuspension in carbon dioxide-saturated, distilled water until no further pigment could be removed. The hemoglobin and other cell contents are released by this procedure, leaving only the structural portion of the cell. In this process the membrane structure is, in general, partially destroyed. However, electrical impedance measurements of the stromata indicate that approximately ten per cent of the cell membranes remain intact. The absorption was measured over the frequency range from 800 to 2400 kilocycles and the temperature range from 5 to 45 C. The data for albumin are typical of the entire set of measurements. In figure 3 absorption is plotted as a function of temperature. The temperature coefficient is negative and increases slightly in magnitude at the lower temperatures. Figure 4 presents these same data as a function of frequency.

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[1] Pennell, R. B., and Smith, W. E.: Preparation of Stabilized Solutions of Hemoglobin, Blood, J. of Hematology, 4:380, 1949.

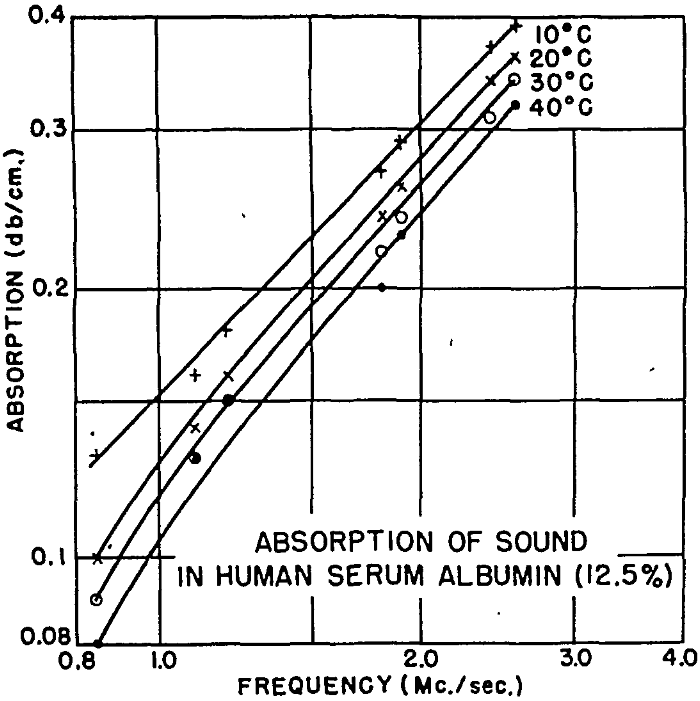

Fig. 4. — Absorption of sound in a 12.5 per cent solution of normal human serum albumin.

TABLE 1. — *Absorption Data.*

FREQUENCY (Mc./sec.)	TEMP. (CENT.)	SUBSTANCE	PROTEIN (gm/100cc)	MEASURED ABSORPTION (db/cm.)	ABSORPTION PER gm/100cc (db/cm.)
1.2	20	PLASMA	5.5	0.08	0.014
		RED CELLS	32.0	0.40	0.013
		HEMOGLOBIN	7.0	0.09	0.013
		ALBUMIN	12.5	0.16	0.013
1.2	40	PLASMA	5.5	0.07	0.012
		RED CELLS	32.0	0.34	0.011
		HEMOGLOBIN	7.0	0.08	0.011
		ALBUMIN	12.5	0.14	0.011
2.4	20	PLASMA	5.5	0.16	0.030
		RED CELLS	32.0	0.94	0.029
		HEMOGLOBIN	7.0	0.17	0.024
		ALBUMIN	12.5	0.34	0.027
2.4	40	PLASMA	5.5	0.13	0.023
		RED CELLS	32.0	0.77	0.024
		HEMOGLOBIN	7.0	0.15	0.021
		ALBUMIN	12.5	0.29	0.023

Table 1 summarizes the absorption data for samples of plasma, concentrated red cells, hemoglobin and albumin. Differences in plasma absorption from sample to sample were as high as 30 per cent. The plasma data given in the table are averages for several samples of horse plasma. Protein determinations were made by the Kjeldahl method. The actual measured absorption is given for the frequencies 1.2 and 2.4 megacycles and for 20 and 40 C. The data are then reduced to an equivalent absorption for a 1 per cent solution of protein by weight. This step, therefore, assumes a linear relation between absorption and concentration. This assumption has been validated for the red cells by direct experimental measurement.

Discussion

First, compare the data of table 1 for the red cells and hemoglobin. The similarity of the data in these two cases show that the protein, hemoglobin, is responsible for the absorption and that whether or not it is contained in cells makes very little difference. In addition, the table shows that the absorptions per gram for all the protein solutions investigated are the same within the limits of experimental error. If the size of the molecule is important in determining the absorption, it is reasonable to make such a comparison. Both hemoglobin and albumin have molecular weights of the order of 60,000 — 70,000 and axis ratios of the order of 5 to 9. More than 90 per cent of the red cell protein is hemoglobin. In plasma roughly 60 per cent of the proteins are albumin. The globulins, which make up the remaining fraction of the plasma proteins, however, are from 2 to 7 times larger than albumin and in certain cases highly asymmetric. Yet, it is unlikely that any one of the globulins is present in sufficient quantity to show its characteristics in the total plasma absorption.

The absorption of a suspension of stromata in the concentration found in the red cell residues of centrifuged blood is approximately 0.03 db/cm. at 1.2 megacycles and 20 C. In other words, the cell membrane accounts for less than 10 per cent of the 0.40 db/cm. measured for concentrated red cells at this temperature and frequency. Thus, if structural losses exist, they can account for only a small part of the total absorption. On the other hand, it is reasonable to classify even these small losses caused by the stromata as volume absorption. A computation, using the values of Ponder[2] for the dry weight of the stroma, gives the value 0.025 db/cm. for the absorption of a suspension of one gram of stromata per 100 cc. This is roughly twice the comparable value for the protein solutions of table 1. However, in view of the highly ordered arrangement of the structural proteins of the stroma, this may be considered rather close agreement.

It may, therefore, be concluded that volume absorption is almost entirely responsible for the losses in blood and furthermore that, at least for similar molecules, the absorption is in direct proportion to the quantity of protein present.

It is interesting to speculate further regarding the losses caused by the proteins. Simple, classical viscous and heat conduction losses can be ruled out, since both these mechanisms give an absorption which depends upon the square of the frequency, whereas the measured absorptions were all very nearly linear functions of frequency over the range investigated. A more likely possibility is that the absorption results from some form of molecular relaxation. One example of such a process would be the rotation of the molecule about one of its axes through coupling between translational and rotational forces. At very low frequencies the molecule can respond completely. At very high frequencies, on the other hand, the large inertia of the molecule will prevent it from responding to the rotational forces. Such an absorption mechanism could account for the frequency dependence of the absorption which has been observed in these measurements. An equally plausible explanation of the observations is that the large loosely bound protein molecules are not completely elastic under compressional and dilitational forces, i. e., when the compressional force has been applied and then removed the molecule may not completely return to its equilibrium size or shape. This amounts to a kind of elastic hysteresis.

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[2] Ponder, E.: Red Cell Cytochemistry and Architecture, Ann. New York Acad. Sc., April 19, 1946.

Conclusions

The investigation of blood and its components has shown that the presence of protein molecules is sufficient to account not only for the entire absorption in blood but also for a significant portion of the absorption in many of the solid tissues. Thus in studying the effects of intense sound on tissue, it would appear wise to give particular attention to the proteins. Wu[3] and Liu in 1931 and Chambers[4] and Flosdorf in 1936 reported coagulation of egg albumin by ultrasonic and sonic vibrations. In both cases this phenomenon was associated with cavitation. However, it is apparent from the present work that even in the absence of cavitation strong, dissipative forces are exerted on the protein molecules. The mechanisms of the action of ultrasound with and without cavitation should be quite different.

The importance of the proteins in the absorption processes should by no means rule out consideration of structural absorption in the solid tissues. Nelson[5] and others have shown that excess heating does occur at macroscopic interfaces. This investigation has shown, however, that interfaces of the size of the red cell membrane are too small to produce a significant reflection or scattering of waves of the order of 1 millimeter in length. Thus, specific effects on cell membranes are not to be expected. More work will be required to determine the precise conditions under which structural absorption becomes important.

ACKNOWLEDGEMENTS: The authors wish to acknowledge the important help of Dr. John G. Reinhold, Assistant Professor of Physiological Chemistry, Hospital of the University of Pennsylvania, for performing the protein determinations used in this work, Mr. John Parnell of the Moore School of Electrical Engineering of the University of Pennsylvania, and Dr. George Cathers of the Franklin Institute, for many helpful discussions and Messrs. Kam Li and Charles Mack for assistance in performance of measurements.

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[3] Wu, H., and Liu, S. C.: Coagulation of Egg Albumin by Supersonic Waves, Proc. Soc. Exper. Biol. & Med. 28:782, 1931.

[4] Chambers, L. A., and Flosdorf, E. W.: The Denaturation of Proteins by Sound Waves of Audible Frequencies, J. Biol. Chem. 114:75, 1936.

[5] Nelson, P.; Herrick, J. F., and Krusen, F. H.: Temperatures Produced in Bone Marrow, Bone and Adjacent Tissues by Ultrasonic Diathermy, Arch. Phys. Med. 31:687, 1950.

* * *

PRESCRIBED OCCUPATIONAL THERAPY*

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The prescription of occupational therapy can be discussed from various approaches: that of the physician, that of the occupational therapist and that of the actual terminology of a prescription.

Medical students in schools now offering elective or required courses in Physical Medicine and Rehabilitation are probably exposed to at least one hour of formal discussion about occupational therapy. Residents in Physical Medicine and Rehabilitation are undoubtedly spending more time in study of this field. Probably the only other physicians who have had any lectures or discussions of occupational therapy are those residents trained in Veterans Administration Psychiatric and Tuberculosis hospitals where a full rehabilitation program has been developed with a Physiatrist in charge.

Occupational therapists often work independently in all types of hospitals without any medical guidance. The situation, in general, is no different from that which Dr. William Benham Snow describes[1] as the situation at Columbia Presbyterian Medical Center up until approximately six years ago where (quote) "occupational therapy . . . was an independent service freely available to the total medical staff, but directed by an occupational therapist accountable to one of the woman's auxiliary lay committees." Under this system, the occupational therapist received "requisition" to treat patients. These were not prescriptions.

Dr. Snow analyzed six months of such requisitions furnished in 1950 from three sections of the Columbia University Medical Center, and found that the occupational therapy procedures could be considered to have been used for diversion, mental hygiene, psychiatric help or kinetic treatment (old term, functional).

A few "requisitions" were rejected. It seems safe to assume that the treatment category as well as that of rejections, may well have been subject to the decision of an occupational therapist rather than a physician. Furthermore, the usual requisition probably merely called for "occupational therapy." Such requisitions could not be considered prescriptions. The statistics from Columbia can probably be duplicated in most general hospitals where occupational therapists are employed.

If occupational therapy is really a worth-while therapeutic procedure, then a request labeled merely "O. T." places an occupational therapist in exactly the same position of practicing medicine as it does any physical therapist who receives and accepts a prescription for "P. T." The technical directors of any approved occupational therapy school, and their graduates, will all tell you that they work only under a doctor's prescription. The Baruch Committee on Physical Medicine stated that[2] "This extensive field of medicine practice includes the employment of the physical and other effective properties of light, heat, cold, water, electricity, massage, manipulation, exercise and mechanical devices for physical and occupational therapy, in the diagnosis or treatment of disease." Yet, the president of the American Occupational Therapy Association wrote the author of this paper the following: "Occupational Therapy is a professional service available to all medical specialties and as such it has not been deemed advisable that it be under the supervision or administrative control of any other medical specialty group."[*] This is confirmed in the American Occupational Therapy Association statement of policy.[†]

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* Read at the Twenty-Ninth Annual Meeting of the American Congress of Physical Medicine, Denver, Colo., Sept. 7, 1951.

[1] Snow, William Benham, and White, Helen M.: Economic Factors Involved in the Occupational Therapy Program of a General Hospital, Arch. Phys. Med. 33:315 (May) 1951.

[2] Krusen, Frank K.: History and Development of Physical Medicine; Physical Medicine in General Practice. Report of the Baruch Committee on Physical Medicine, April, 1944. Edited by Arthur L. Watkins. J. B. Lippincott Co., Philadelphia.

The national organization (A. O. T. A.) does not want to affiliate with Physical Medicine exclusively, which would subject them to (and have) medical direction from physicians who have training in their field. The argument that a physiatrist would not know how to prescribe for a tuberculous or psychiatric patient is sheer nonsense. The national organization prefers to control their national registry rather than affiliate in any way with the American Medical Association. The implication is that organized occuptional therapy does not want good medical supervision, but prefers its therapists either to practice medicine or be supervised or accountable: — as Dr. Snow said, "to one of the women's auxiliary lay committees."

Many physicians realize the value of occupational therapy. Physiatrists who have opportunity to coordinate physical and occupational therapy are able to increase the importance of occupational therapy and to find many real therapeutic uses for it — not just diversion. The Baruch Committee definition elevates occupational therapy to an equal level with physical therapy as a therapeutic tool. Occupational therapists are defeating themselves and delaying progress as long as they are unwilling to align themselves with the medical specialty where physicians also have formal training in the therapeutic use of this field.

It is a fine thing to report proceeds of sales to a women's auxiliary group, be patted on the back, then have the same volunteers interested enough to get donations for another loom. The occupational therapist becomes a king or queen to this group. It is not always easy to relinquish this position of authority and work under medical supervision.

Physical therapists have faced the same problem for years — but in a slightly different fashion. The difference was well expressed by a legal advisor for the American Medical Association, particularly concerned with Physical Medicine and Physical Therapy. This question was asked: if physical therapy licensing legislation is important then why should the occupational therapist not be licensed also; the Baruch Committee's definition of Physical Medicine includes both equally? The answer was: since the occupational therapists never do anything to hurt patients, they have no need for licensure. Since anyone who deals with patients can hurt them by mistreatment or mishandling, this is a sorry commentary on any therapeutic value of occupational therapy. Even the "push button" technicians in "physiotherapy" have wanted medical coverage to take responsibility for a burn or some untoward result in treating a fracture. When there is no physiatrist, many physical therapists still receive prescriptions for "P. T." or "heat, massage and exercise." After they have examined the patient they tactfully call the referring physician and get clearance for their suggested treatment. It is doubtful if this is a common occuptional therapy practice.

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[*] Personal communication to author dated August 1, 1950

[†] *STATEMENT OF POLICY* — American Occupational Therapy Association Occupational Therapy is a professional service which uses purposeful activities to aid the patient in recovery from and/or adjustment to disease or injury. It is prescribed by the patient's physician and administered by the occupational therapists with consideration not only of the specific disability but also of the patient's physical, mental, emotional, social and economic needs

Relationship with the Physician

In the fields of psychiatry, pediatrics, tuberculosis and other medical specialties it is essential that the patient's physician prescribe occupational therapy in relation to the total treatment program In order to insure continued guidance it is necessary that there be frequent contact between the therapist and the physician

The Education of the Occupational Therapist

The Education of the occupational therapist has been determined by the demand of the various fields of medicine in which this service is needed Balance in emphasis on the medical specialties must, therefore, be maintained

The American Occupational Therapy Association Educational Program

The American Occupational Therapy Association believes its professional courses can be most effectively directed by qualified occupational therapists in accordance with the essentials established by the American Medical Association for acceptable schools of occupational therapy Advisory committees made up of representatives of the medical and allied professional fields are invaluable to the administration of the educational program.

Registration

Professional registration is an integral part of the educational program and as such has been established and is maintained under the jurisdiction of the American Occupational Therapy Association.

The occupational therapists have a right to make certain requests regarding their prescriptions. First, they do not want one craft specified except in very special instances. A choice of crafts can often be used to fulfill the prescription and provide the patient with an activity that interests him. Furthermore, particularly for kinetic occupational therapy, if the prescription does not limit the craft, the therapist can graduate the patient from light to medium to heavy work as his strength, range of motion or physical tolerance improves.

Secondly, they feel that a moderate leeway of time should be permitted rather than exact minutes in specifying work tolerance. Attention span may be even shorter than the patient's physical tolerance so that it may take several short periods to fulfill a prescription for the exact time. As the patient's attention span and interest improve, so may his physical tolerance.

Some occupational therapists have been trained to check pulse and respirations and have received more lectures from physicians than others. When all occupational therapists have had medical training at least equal to that of the physical therapist (preferably by combined school), then their judgment of physical tolerance can be trusted still more. Clear cut tests for physical tolerance are still inadequate. Daily work with a patient and observation often offer the basis for quite adequate judgment of a patient's tolerance.[3]

Logically, the next point to consider is the terminology to be used in prescribing occupational therapy. A more unified terminology is needed. In 1947 Dr. Sidney Licht made a plea for a change in nomenclature for occupational therapy prescriptions and published a proposed outline.[4] That nomenclature is clear and generally accepted, but advances in Physical Medicine and Rehabilitation since 1947 necessitate further additions to occupational therapy prescriptions. A proposed new outline is as follows:

PRESCRIPTION FOR OCCUPATIONAL THERAPY

Department of Physical Medicine and Rehabilitation Hospital for Chronic Illness,
Rocky Hill, Connecticut.

A. DEFINITIVE

I. Kinetic (functional)
  a. Muscle strength
  b. Joint mobilization
  c. Coordination

II. Metric
  a. Improve work tolerance
  b. Measure progress of tolerance

III. Tonic
  a. Muscle tone
    1. Recondition
    2. Prevention of decondition
  b. Mental tone
    1. Stimulation
    2. Sedation

IV. Psychiatric
  a. Psychomotor activity
    1. Stimulation
    2. Sedation
  b. Emotional disturbance
    1. Emotional stability
    2. Mood
  c. Behavior training
  d. Abnormal mental content
    1. Guilt complex
    2. Paranoid trends
  e. Psychosocial activity
    1. Socialization
    2. Provide obtainable objective
  f. Diagnosis
    1. Reaction during treatment

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[3] Clarke, H. Harrison: Application of Measurement to Health and Physical Education, Prentice-Hall, Inc., New York, 1950.

[4] Licht, Sidney: The Prescription of Occupational Therapy, New York State J. Med. 48.1032 (May 1) 1948.

        2. Identification of problems
        3. Determine intellectual work capacity
        4. Prevocational exploration
    g. Mental Hygiene
        1. Overcome restlessness
        2. Promote good work and play habits

B. ACTIVITIES OF DAILY LIVING

I. Bed activities
    a. Put on and remove pajamas
    b. Turn pages of book and newspaper
    c. Wind wrist watch
    d Open and close safety pin
II. Hygiene
    a. Wash face, hands and extremities
    b. Trim and clean nails
    c. Brush teeth and comb hair
    d. Shave or women apply cosmetics
III. Eating
    a. Eat with fingers, butter bread
    b. Eat with fork or spoon
    c. Cut meat with knife and fork
    d. Drink from glass or cup
IV. Dressing
    a. Put on and remove slipover or button shirt, hose and slippers, tie or buckle shoes
    b. Tie bow or tie
V. Utilities (ability to operate)
    a. Door fastenings
    b. Light switches
    c. Window, blind and shade
    d. Pencil sharpener and scissors
    e. Faucets and bottle tops
VI. Communication (ability for and training in)
    a. Write or type name
    b. Use dial pay telephone
    c. Tell name and address
    d. Understand directions
    e. Open letter, read and replace
    f. Handle money

C. PREVOCATIONAL TESTING

I. Work habits
    a. Neatness and accuracy
    b. Speed and ability
    c. Alertness and concentration
    d. Works best alone or with others
    e. Follows instructions
II. Personality and attitude factors
    a. Interest
    b. Cooperation
    c. Stability
    d. Shows initiative
    e. Shows leadership
III. Work abilities
    a. Finger dexterity and grasp
    b. Reaching, lifting and carrying
    c. Ability to handle power and hand tools
    d. Arm motion and coordination
    e. Use of affected parts.

The foregoing outline divides occupational therapy into three divisions — definitive, functional and prevocational. The written prescription need not be as detailed as all the sub-headings in each section imply.

Physical therapists and corrective therapists are training patients in "Activities of Daily Living" so that physical rehabilitation may be accomplished. This is called "functional" training to differentiate it from the specific and definitive treatments used in physical therapy to treat affected parts of the body. A well-rounded Physical Medicine and Rehabilitation Department has the occupational therapists teaching Activities of Daily Living, involving use of the hands in eating, dressing, shaving and writing, and use of all ordinary utilities. The use of the hands for learning these procedures is a natural occupational therapy activity. This should also be called "functional" in occupational therapy.

If any occupational therapy is definitive treatment, then it should particularly apply to prescriptions which request a craft to increase range of motion, strength or coordination for one or both hands, wrists, elbows or of an entire extremity. While this type of occupational therapy has been called "functional" for years, use of the term "kinetic" is far more specific and descriptive.

Not all occupational therapy schools have placed sufficient stress on either functional training in Activities of Daily Living or in prevocational testing. Occupational therapists should be able to furnish much valuable prevocational information which would be a definite help to the manual arts therapists, vocational counsellors or potential employers. While the occupational therapist is not expected to do vocational counselling, he or she can tell a vocational counsellor if the patient is able to do fine finger work; if the arm and hand movements need be gross; if the patient can follow instructions, or if he must be consistently supervised; if he is a neat and steady worker, or whatever his physical tolerance or attention span may be. Furthermore, therapists, with their knowledge of kinesiology, are able to devise adjustable splints or other adaptive gadgets that will make certain activities or occupations possible. This information a manual arts therapist will not have.

Severely disabled patients or those with poor physical tolerance can best start with light craft work and be graduated to heavier work whether it is in occupational therapy or in manual arts. Some patients are physically and mentally able to do occupational therapy and manual arts therapy simultaneously. The development of physical tolerance and the correct use of the injured nerves, muscles and joints requires some medical training. Since manual arts and educational therapists have had no medical training, and corrective therapists little or none in their physical education courses, supervision of manual arts therapy and educational therapy by occupational therapists, and corrective therapists by physical therapists, is medically advisable. It should also improve the coordinate team work program of total rehabilitation for the whole man. Each group can also learn from the other. Occupational therapists may be able to start primary prevocational testing long before a patient is physically able to start in manual arts. The occupational therapist is not turned into a vocational counsellor because of the prevocational testing, but he or she becomes more aware of the total problem, just as he or she is made more aware of physical therapy if permitted to work on a coordinate program with physical therapists under the guidance of a physiatrist who has the concept, philosophy, and training to prescribe a total program. Occupational therapists and physical therapists can work together on functional training. The occupational therapist can learn to interpret manual muscle tests and how to measure range of motion — thereby making their own kinetic treatment more accurate.

Sedgwick Mead discussed "Failures in Occupational Therapy"[5] at the American Congress of Physical Medicine meeting in 1950. Both Snow and Mead have clearly pointed out the obvious faults. No matter how excellent the training is in approved schools of occupational therapy, no matter how sincere the director and the students, recognition of the field as a therapy will probably not come until certain policies are changed. It should be apparent that the correct prescription of occupational therapy can only be done by physicians trained in the field if occupational therapy is to be dignified by the term "therapy." The occupational therapists can strengthen their position and win respect for their chosen profession only when they are willing to ally themselves officially with specially trained physicians. They can also strengthen their profession by being willing to ally themselves more closely with the American Medical Association. Furthermore, if physical therapy and occupational therapy were to have equal licensure, they would be on an equal legal level of recognition. Until they are willing to make these changes for strength and growth, outside of special Physical Medicine and Rehabilitation centers, we can assume occupational therapy will be nothing but fluttery attempts at diversion and not prescribed therapy.

Two recommendations are made in conclusion:

1. That the executive committee of the American Congress of Physical Medicine appoint a committee to meet and adopt standard terminology for the prescribing of occupational therapy. (Perhaps the outline presented here could be a basis for an official terminology.)
2. That official recommendation be made to the American Occupational Therapy Association by the American Congress of Physical Medicine as to suggested changes in policy that this medical association feels would strengthen the occupational therapy profession, and officially make those therapists a

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[5] Mead, Sedgwick, and Alex Harell: Failures in Functional Occupational Therapy, Division of Physical Medicine, Washington University School of Medicine, read at Annual Meeting, American Congress of Physical Medicine, September, 1950.

part of the field of Physical Medicine and Rehabilitation as officially defined by the Baruch Committee on Physical Medicine.

Discussion

Dr. Herman L. Rudolph (Reading, Pa.): It is gratifying to note increasing interest in the field of Occupational Therapy with allotment of precious time to a paper on the subject. The pathetic prewar state of a floundering group has been transformed only in the past several years to one of considerable importance particularly in the field of Physical Medicine and Rehabilitation. During the past war many of us were in a position to watch the development of Occupational Therapy from a relatively unknown entity to its present peak of performance in the military hospital. The elaborate departments in the veterans' hospitals and a number of the large city institutions are patterned chiefly after the military and are maintained as far as I know as components of the Physical Medicine and Rehabilitation Services whose directors, physiatrists, are responsible for function of the Occupational Therapy Sections. It is with pardonable pride but with due humility that I consider myself well-informed in matters of Occupational Therapy. Dr. Covalt's information concerning the O. T. Association hierachy's statement of policy to the effect that it is undesirable to be under the supervision or administrative control of any one medical specialty is shocking news to me. There is reason to believe that this could not be the consensus in the rank and file of working Occupational Therapists. That Occupational Therapy can avert stagnation at pre-war levels without supervision by one medical specialty is utterly fantastic and sheer nonsense and bespeaks misinformation and misguidance. Be that as it may, it being undeniably true that the specialty of Physical Medicine and Rehabilitation has been the prime sponsor in the revival of O. T., the Congress should endorse Dr. Covalt's recommendation by immediate appointment of a committee to study ways and means to secure and maintain affiliation of O. T. with the field of Physical Medicine and Rehabilitation.

The matter of prescription may or may not be a problem, depending on one's point of view. Because of the individuality of human frailties inherent in physician, therapist, and patient, the standardization of anything in O. T. is hardly desirable. The therapist may want necessary information by prescription, but until some very far distant future when all physicians prescribing O. T. will be fully informed, the better method of securing this necessary information is a tactful discussion with the referring physician. I concur in the desire to avoid craft specification; the qualified therapist with a good background in craft analysis will, except in a rare instance, hardly ever encounter request for a specific craft.

Standardization of terminology is probably premature. Dr. Covalt presents a comprehensive outline which further expands yet simplifies the approach to a suitable prescription. I am sure, however, there will be some dissension and differences of opinion. It is hoped that this paper may stimulate thought along this line and with additional material for consideration, perhaps unanimity of opinion concerning terminology may be attained sooner or later to energize general acceptance.

Dr. Gloria Roth (Denver, Colo.): I don't want to go into too much detail because I imagine I may be a little out of order; but I believe the viewpoint of our national office, on affiliating with the Congress of Physical Medicine is based upon the fact that occupational therapy does have many other fields beside that of physical disabilities and rehabilitation.

The occupational therapist who wants to go into physical medicine usually specializes, and should specialize, to further her knowledge of physical disabilities. The initial training course at the university covers all the various fields — physical disability, psychiatry, pediatrics, GM&S, prevocational work, shelter workshops, and CP programs. It is impossible to have very skilled, fine knowledge of each thing when you graduate; but it is the current trend for the occupational therapist upon graduation to specialize in one field or another, and to go on with good postgraduate study.

Consequently, the occupational therapist who is interested in physical medicine very definitely wants to be under the supervision of the physiatrist in such physical medicine setups, and I believe you will find that the current trend is for the occupational therapist to want as definite a prescription for her work as the physical therapist. Likewise, with the occupational therapist in the psychiatric field the current trend is to be under the psychiatrist directly, and have just as specific a prescription as the occupational therapist wants under the physiatrist.

When there is no physiatrist in charge of the program, the occupational therapist is just as demanding of a correct order from the ward doctor as the occupational therapist is in the other two fields mentioned.

In the field of tuberculosis, which is usually under the physiatrist, the occupational therapist is very happy and willing to cooperate and wants to be under the supervision of the physiatrist. I think it is just a matter of what the specialty may be.

No matter what the specialty is, I believe you will find that the occupational therapist is always willing to be under supervision, particularly those of the newer schools of occupational therapy. It isn't so much not wanting to be under physical medicine — it is more that we are trying to save our over-all program, and want to place ourselves under the appropriate supervision, no matter what field we go into.

Dr. Nila Covalt (Rocky Hill, Conn., closing): I think I need say only that I proved my point.

INEFFECTIVENESS OF ULTRAVIOLET HEMO-IRRADIATION IN DISTEMPER [*]

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The literature on ultraviolet irradiation of blood suggests the effectiveness of such therapy in the treatment not only of bacterial but also of virus infections. There is sufficient evidence in the literature, since the work of Carré,[1] to show that distemper in dogs is caused by a filtrable virus. It has been successfully transmitted by a bacteria-free filtrate of nasal secretions from an infected dog. Puntoni[2] established the presence of a virulent distemper virus in dogs by serial transmission, utilizing intracranial inoculation. The work of Green and associates[3-5] demonstrated the extensive distribution of the distemper virus. By scraping transitional epithelium from the urinary bladder a rapid method for diagnosis of distemper was introduced. Green stated that the basic virus infection in dogs produced by canine distemper virus is a generalized systemic disease and continues its invasion until mobilization of immunity brings about recovery, or until damage to the animal's tissues causes a fatal termination of the infection. DeMonbreun[6] reported that the virus of canine distemper has a definite affinity for vascular endothelium and for cells of the reticuloendothelial system. In his opinion it spreads mainly by the blood stream and the evidence for its passage along nerve pathways is not convincing.

The consensus is that distemper is a virus disease characterized by an incubation period of three to six days. The temperature rises slightly during the incubation period but returns to normal in a few days. By the tenth or eleventh day a second rise in temperature occurs and gradually a purulent discharge appears on the nostrils and eyes. Both nostrils and eyes are often pasted shut with a sticky exudate. Blood-stained diarrheal feces are accompanied by severe dehydration and reduction of weight. Death may occur shortly, or the animal may slowly recover in several weeks. In some cases nervous symptoms develop in addition to the respiratory or enteric form of the disease or both. Convulsions may occur infrequently in the beginning but gradually become more frequent until only a few minutes separate the attacks. At necropsy severe bronchopneumonia or severe inflammation of the intestinal mucosa or both are seen. The clinical picture of this virus disease is such that it makes the disease very fitting for appraisal of the effectiveness of ultraviolet irradiation of the blood of dogs stricken with distemper.

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[*] Read at the meeting of the American Congress of Physical Medicine, Denver, Colorado, September 6, 1951.

1. Carré, H. (Presented by Roux): Sur la maladie des jeunes chiens, Compt. rend. Acad. d. sc. 140:689; Sur la maladie des chiens, 1489, 1905.
2. Puntoni, V.: Quoted by Green, R. G., and Carlson, W. E. S.
3. Green, R. G.: Newer Aspects of Virus Diseases of Dogs, North Am. Veterinarian 23:526, 1942.
4. Green, R. G., and Evans, C. A.: Cornell Veterinarian 29:35, 1942.
5. Green, R. G., and Carlson, W. E.: The Immunization of Foxes and Dogs to Distemper With Ferret-passage Virus, J. Am. Vet. M. A. 107:131 (Sept.) 1945.
6. DeMonbreun, W. A.: The Histopathology of Natural and Experimental Canine Distemper, Am. J. Path. 13:187 (Mar.-Apr.) 1937.

The evidence accumulated seems to indicate that the impingement of small, carefully regulated doses of selected ultraviolet rays directly on the blood stream in some way increases the bactericidal properties of the blood stream. Miley[7] stated that ultraviolet irradiation of blood is a practical method of reproducing bactericidal, detoxification, vaccine and vasodilatation effects. He reported[8] rapid disappearance of the classic signs following ultraviolet irradiation of blood in patients suffering from thrombophlebitis.

Miley[9-10] found ultraviolet irradiation of blood alone to be a successful method of controlling acute pyogenic staphylococcemia in 9 consecutive cases. He noted that sulfonamide drugs lowered the resistance to such an extent that ultraviolet therapy failed to control the staphylococcemia when used in conjunction with these drugs.

Miley[11] summarized the chief physiologic events observed after ultraviolet irradiation of blood as follows: (1) rapid and efficient control of bacterial infection other than bacterial endocarditis; (2) control of infections due to a virus or virus-like organism; (3) increase of efficiency of oxygen exchange mechanisms. Rapid disappearance of cyanosis, increase of the ability to breathe freely and the appearance of normal pink coloration of the skin were observed in cases in which bronchial asthma was treated by ultraviolet hemoirradiation. It was stated that an increase in venous oxygen occurred. However, it should be emphasized that if the oxygen in venous blood was increased, it may mean that the tissues were unable to utilize the oxygen brought to them by arterial blood. This may not be a beneficial attribute; (4) another effect of the ultraviolet irradiation of blood was its detoxicating action. Miley reported that toxic symptoms subsided within twenty-four to seventy-two hours after irradiation of blood.

Miley, Seidel and Christensen[12] concluded that ultraviolet irradiation of blood caused a marked and relatively permanent alleviation of severe dyspnea and cyanosis plus an increase in general resistance in a relatively large percentage of patients suffering from intractable bronchial asthma. Barger[13] gave 42 treatments by irradiation of blood to 12 patients who had bronchial asthma. He stated that the outcome was gratifying: the patients, as well as their physicians, spoke cordially of the treatment and of the results.

Miley and Christensen[14] stated that ultraviolet irradiation of blood can be relied on to control an infection of a virus or virus-like nature consistently in a safe and efficient fashion; that the rapid subsidence of toxic symptoms due to infections of a virus or virus-like nature occurs with striking regularity

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7. Miley, George: Ultraviolet Blood Irradiation Therapy, Arch. Phys. Therapy 23:536 (Sept.) 1942.
8. Miley, George: *The Control of Acute Thrombophlebitis With Ultraviolet Blood Irradiation Therapy*, Am. J. Surg. 60:354 (June) 1943.
9. Miley, George: Disappearance of Hemolytic Staphylococcus Aureus Septicemia Following Ultraviolet Blood Irradiation Therapy; Knott Technique, Am. J. Surg. 62:241 (Nov.) 1943.
10. Miley, George: Efficacy of Ultraviolet Blood Irradiation Therapy in the Control of Staphylococcemias, Am. J. Surg. 64:313 (June) 1944.
11. Miley, George: The Present Status of Ultraviolet Blood Irradiation (Knott Technique), Arch. Phys. Therapy 25:357 (June) 1944.
12. Miley, G. P.; Seidel, R. E., and Christensen, J. A.: Preliminary Report of Results Observed in Eighty Cases of Intractable Bronchial Asthma, Arch. Phys. Therapy 24:533 (Sept.) 1943.
13. Barger, G. J. P.: Discussion, Arch. Phys. Therapy 24:562 (Sept.) 1943.
14. Miley, G. P., and Christensen, J.: Ultraviolet Blood Irradiation Therapy in Acute Virus and Virus-like Infections, Rev. Gastroenterol. 15:271 (Apr.) 1948.

and closely parallels the results reported following the use of intravenous irradiation of blood in acute pyogenic infections. They expressed the belief that the resistance of the host is raised rapidly and efficiently by a direct stimulating and energizing effect following intravenous introduction of ultraviolet energy. Barger[15] reported observations on patients in the Washington epidemic of bulbar poliomyelitis treated by ultraviolet irradiation of blood which confirmed Miley's findings.

Rebbeck[16-18] reported that practically no increase in temperature was noted after operation when ultraviolet hemo-irradiation was administered preoperatively, and that definite protection was afforded against the usual disastrous spread of uterine infection in the pelvis or into the blood stream. He stated that preoperative ultraviolet irradiation of blood provides a safe means for protection of poor operative risks and causes a marked decrease in the morbidity and mortality rates. He reported recovery of 5 of 7 patients who had Escherichia coli septicemia treated by ultraviolet irradiation of blood. He stressed the fact that there have been no signs of harmful effects in approximately 4,000 blood irradiation treatments with the Knott technique. In discussing this report Barger[19] stated that Rebbeck was moderate in comment on his results in conditions that usually show a high mortality rate. Barger emphasized the surprisingly small range of safe and effective exposure of the blood as it flows turbulently through the irradiating chamber; namely, an exposure of less than nine seconds is relatively ineffective, and an exposure of more than fourteen seconds is increasingly toxic to the body. An exposure of nine to fourteen seconds is believed to be powerfully effective and safe.

Rebbeck treated 110 unselected patients postoperatively by ultraviolet irradiation of blood out of a series of 336 who had undergone operations on the biliary tract. He reported marked reduction in the number and severity of postoperative complications in the cases in which irradiation was used. Abdominal distention was reduced, the need for antibiotic therapy was greatly minimized and thrombophlebitis was decreased in these cases.

Rebbeck and Walther[20] reported that in 1 case they cured proved double septicemia by ultraviolet irradiation of autotransfused blood.

In severe peritonitis with postoperative ileus, Olney[21] reported that ultraviolet irradiation of blood proved to be by far the most effective treatment. He[22] stated that in his twenty-five years of practice he had never found any treatment for chronic pelvic cellulitis that compared with ultraviolet irradiation of blood. In his hands, the relief to patients by such treatment was very marked and it was possible to avoid surgical removal of structures that were inflamed.

Moor and associates[23] came to the conclusion that ultraviolet irradiation of blood containing experimentally added bacteria produced no decrease in the number of viable bacteria, and that autotransfusion of irradiated blood had no effect on the mortality rate or time of survival of rabbits given small doses of botulinus toxin. They stated that there is no basis for the use of hemo-irradiation in the treatment of infections. Barger[24] agreed with Moor and associates[23] concerning the failure to decrease the number of viable bacteria but stated that the disappearance of septicemia and clinical recovery was actually a more subtle process requiring twenty-four to forty-eight hours. He stated that clinical work with new therapeutic procedures of necessity runs far ahead of the scientific research to provide its rationale.

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[15] Barger, G J. P. Discussion, Arch. Phys Med 29:342 (June) 1948.

[16] Rebbeck, E W Ultraviolet Irradiation of Autotransfused Blood in the Treatment of Post abortional Sepsis, Am J Surg 55:476 (Mar.) 1942.

[17] Rebbeck, E W Preoperative Hemo irradiations, Am J Surg 61:259 (Aug) 1943.

[18] Rebbeck, E. W. Ultraviolet Irradiation of Blood in the Treatment of Escherichia Coli Septicemia, Arch. Phys. Therapy 24:158 (Mar) 1943

[19] Barger, G J. P Discussion, Arch Phys Therapy 24:165 (Mar) 1943

[20] Rebbeck, E W, and Walther, R A. Double Septicemia Following Prostatectomy Treated by the Knott Technique of Ultraviolet Blood Irradiation, Am J Surg 57:536 (Sept.) 1942.

[21] Olney, R C. Ultraviolet Blood Irradiation in Biliary Disease; Knott Method, Am J Surg. 72:235 (Aug) 1946

[22] Olney, R C. Ultraviolet Blood Irradiation Treatment of Pelvic Cellulitis; Knott Method, Am J. Surg. 74:440 (Oct) 1947.

[23] Moor, F. B ; Hoyt, R E, and Levine, M G An Evaluation of Hemoirradiation Therapy, Arch. Phys. Med 29:358 (June) 1948

Methods

Before we proceeded with this study Dr. Knott came in person to Rochester, discussed the machine with us in detail and explained all the particulars of the procedure of hemo-irradiation in a very objective and most commendable manner. In fact, he emphasized that he is interested in finding out most scientifically and objectively whether the procedure really has a place in therapy. The procedure that he gave us in detail, and which we followed meticulously, is as follows: Three important factors were kept strictly constant; (1) the amount of blood withdrawn and irradiated; (2) the time of exposure to ultraviolet energy; (3) the intensity of ultraviolet radiation.

The amount of blood withdrawn and irradiated was 1.5 cc. of blood per pound of body weight. By a very careful procedure Knott[25] found that the total amount of blood to be irradiated is about one sixteenth to one twentieth of the estimated blood volume or approximately 1.5 cc. per pound of body weight. Twenty cc. of blood were irradiated every ten seconds. This was done by setting the volume control of the pump at 20.

The intensity of ultraviolet radiation is regulated by the voltmeter control, which was operating strictly between 50 and 55 volts during irradiation of the blood. Irradiation was delayed until the lamp voltage built up to 50 volts.

Thirty dogs stricken with distemper were used in this study; 15 were kept as controls and 15 were irradiated. The neck of each treated dog was shaved and cleaned with soap and water and then with thiminosal (Merthiolate^R) solution. The calculated amount of blood (1.5 cc. per pound) was withdrawn aseptically from the jugular vein into a syringe containing the required quantity of sodium citrate to prevent clotting and the mixture was returned by the action of the blood control unit of the hemo-irradiator to the dog's venous circulation after having been exposed enroute to ultraviolet rays at the rate of 20 cc. every ten seconds. Irradiation was continued until all the blood was out of the machine. Special precautions were taken to close the shutter and prevent irradiation of any of the saline solution infused either before or after the blood was transfused.

Four groups making a total of 30 dogs with distemper were used in this study; 15 were kept for controls and 15 were treated with ultraviolet irradiation of blood, according to the procedure described previously. The dogs in each of the four groups were divided equally; one half of them were used as controls, the other half were irradiated. The treated as well as the control dogs were kept in the kennels under identical conditions and given the same food and care. From past experience with distemper it has been learned that either recovery or death of the animal usually occurs within fifteen days from the start of illness. This was the reason for our taking fifteen days as the period during which the animals were closely observed.

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[24] Barger, G. J. P.: Discussion, Arch. Phys. Med. 29:364 (June) 1948.

[25] Knott, E. K.: Development of Ultraviolet Blood Irradiation, Am. J. Surg. 76:165 (Aug.) 1948.

TABLE I. — *Effect of Ultraviolet Hemo-irradiation on Distemper in Dogs.*

	Group 1		2		3		4		Total	
	Controls*	Irradiated	Controls*	Irradiated	Controls*	Irradiated	Con trols*	Irradiated	Controls*	Irradiated
Number of animals used	3	3	4	4	4	4	4	4	15	15
Number that remained alive†	2	2	3	1	2	3	4	2	11	8
Number that died‡	1	1	1	3	2	1	0	2	4	7

* The controls were given no therapy.
† Alive 15 days after hemo-irradiation.
‡ *Died within* 15 days after hemo-irradiation.

Results

At the end of fifteen days, 11 of the 15 control dogs remained alive, while of the 15 dogs which were given ultraviolet irradiation of blood, only 8 were still alive on the fifteenth day after treatment. Seven of the dogs which were given ultraviolet irradiation of blood died, while only 4 of the untreated controls died. Table 1 gives the data in detail on both the treated and control dogs.

From the data obtained on the 30 dogs with distemper, it can be stated that ultraviolet irradiation of the blood according to the standard procedure is ineffective in the therapy of distemper.

Discussion

Dr. R. C. Olney (Lincoln, Nebraska): It is my duty as President of the American Blood Irradiation Society to discuss this paper on behalf of the membership of that Society, who are all Fellows of the American Medical Association.

The Knott technique of ultraviolet blood irradiation is one of the most valuable developments in medicine in recent years. During the seven years that I have used it, I have had many occasions when everything else had failed or nothing could be done and death of a patient seemed inevitable, that blood irradiation has definitely brought about recovery. It is under such circumstances that its value can be most appreciated.

It is important to make very clear that the equipment used for this work by Dr. Wakim was equipment furnished to the Councils of the A. M. A. by the manufacturer for their use in the investigation of our work. This arrangement was made at the Mayo Clinic by the Councils at the suggestion of Dr. Krusen for their investigation. Before this work was started I was in Chicago and Mr. Carter told me of this arrangement, by Dr. Krusen, and said that he had been assured that our work would be duplicated and given impartial consideration. The statement by Dr. Wakim that Dr. Knott asked him to "find out whether this procedure really has a place in therapy," is misleading, as Dr. Knott went there to explain the use of the machine and suggest its use in the conditions in which we know it to be effective. We know this therapy is very valuable, and we hoped our work would be duplicated.

It is unfortunate that not one bit of work was done to investigate the vast amount of material which has been reported to the Councils in basic research and clinical evaluation. All of this material was made available to Dr. Wakim and Dr. Krusen and the Council's investigation SHOULD be to thoroughly explore the work reported, some of which has been referred to by Dr. Wakim in his paper. These include the following: First, it has been repeatedly shown that in certain pathologies, with a low blood oxygen, there is a marked increase of blood oxygen of 100 per cent to 200 per cent following ultraviolet blood irradiation. Also, that the phagocytic action of white cells is markedly increased from 50 per cent to 75 per cent following treatment. These two factors are very important in increasing the resistance of the individual. This procedure does not destroy infectious organisms or virus by direct action, but by the increased resistance of the patient. Second, in clinical studies with adequate controls this procedure has proven to be very valuable in septicemias, rheumatic fever in all its forms, virus diseases such as pneumonia and poliomyelitis, severe peritonitis and ileus, thrombophlebitis, and other conditions.

As to Dr. Wakim's work on distemper in dogs as reported, we are not told how the dogs were inoculated, or whether they acquired the disease in the normal manner. We are also not told whether these are alternate cases or selected cases. There were no postmortem reports as to the cause of death or the findings at the time of death. There is likewise no report of the number of treatments given. It is presumed that each dog received one treatment, and that each received a treatment consisting of 20 cc. of blood in ten seconds, which is 25 per cent of the amount of treatment recommended. In seriously ill patients we usually give three or four treatments in as many days, so it seems that these dogs received less than 10 per cent of the treatment I would think necessary. It is most significant and that findings reported are not in agreement with this paper. Reports of other research and clinical work that are being done are most encouraging and the weight of clinical evidence is compelling a search for the proper answer.

Dr. Valentine (North Platte, Nebraska): The investigative study appears to me as too limited in scope; I have had some experience clinically with blood irradiation and consider the clinical entity of distemper as being primarily associated with veterinary practice.

Now, not as an M.D. but as one from the cattle country, I am well acquainted with the clinical course of distemper in animals and will agree that oftentimes comparative studies can be carried over from animals to humans. Having discussed the subject with my friends the local veterinarians, find them agreeing that it is perhaps a virus but also a mixed infection. The paper does not appear to give a definitive description of the organism study.

I should like to complement Dr. Wakim on the over all way that he has presented his investigation; his attention to detail has been excellent. I appreciate his compliments to the originator of the procedure, Dr. Knott, who is a physicist of wide experience.

Dr. Olney and I are from the same general community and I know from this indirect contact that he has carried on a well directed clinical application of this rather specialized type of ultra-violet light therapy. I have used the procedure clinically to a lesser degree but have found it singularly effective in certain types of cases. I feel that it has an overall place in treatment as a general supportive measure. This support is derived from a change that is little understood or recognized but I believe should be described on the basis of helio-therapy. On that basis I respectfully suggest that Dr. Wakim continue his investigation with the hope that we will learn more about the effect of light on living matter.

Dr. Lustig (New York, New York): Regardless of the controversy of the value of hemo-irradiation, I would like to ask Dr. Wakim whether there is still a place for hemo-irradiation considering the modern antibiotic therapy. The indications are mostly virus infections and septicemia, as I understand it.

Dr. D. S. Rausten (Lincoln, Nebraska): Dr. Olney is a friend of mine and a colleague in Lincoln; this problem of hemo-irradiation has been with us for quite a time, and these things have been presented in medical journals and also at meetings locally. In spite of being a friend of my colleague, I also have to be a personal friend to my patient; and, based on the practice of medicine, I have to follow certain scientific backgrounds in which I have been trained.

On the basis of these facts, I believe that hemo-irradiation has not established any specific evaluation of its therapeutic efficacy, but only has claims of assumption of merit.

I feel there should be more scientific data for evaluation of results rather than the so-called "claims of value" without adequate controls for judging results.

My other medical colleagues in Lincoln go along with the same attitude of thought as I have presented.

Dr. Khalil G. Wakim (Rochester, Minnesota): I will answer Dr. Olney's question. I was told by Dr. Knott himself that one treatment was sufficient. There are sufficient reports in the literature to indicate that one treatment is sufficient; so we gave only one treatment.

There was no choice in the matter of animals whatsoever. There were, let us say, 30 dogs taken with distemper in a natural manner, and no inoculations whatever were done. We took those 30 dogs and divided them into four groups. In fact, someone else did the dividing and we gave the treatment.

* * *

SEX DIFFERENCES IN REGISTRY EXAMINATION PERFORMANCE OF PHYSICAL THERAPISTS

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IOWA CITY, IOWA

Theorizing about sex differences always presents intriguing problems. This is particularly true in the occupational world, and especially so in a field like physical therapy, in which workers of both sexes receive comparable training and perform essentially the same sorts of tasks on the job. There would undoubtedly be some "academic" value in establishment of real and significant sex differences in work performance if this were possible. Probably such information would have very real practical values as well, since training programs might be designed to exploit sex differences or different sorts of tasks could be assigned depending upon the sex of the worker.

In any attempts made to study differences among workers, whether differences be based upon sex or age or amount of training or experience or upon whatever variables seem worthy of being investigated, the first, and critical, decision which must be made is to determine the criterion to be used. It may be relatively easy to judge the success of groups of life insurance salesmen; the dollar value of policies sold becomes the criterion. For garment makers the numbers of items completed over a period of time may be considered at least a part-criterion. In these two instances there is a possibility of counting or measuring the products of the workers' efforts. These sorts of criteria tend to be rather reliable or consistent over periods of time, and often a considerable range of success as defined is discovered even among workers who are considered highly satisfactory on their jobs.

But how may we judge the success of physical therapists? Several years ago in an unpublished study by the writer an attempt was made to develop a means of determining differences in on-the-job performance. This study is believed to be the only large scale attempt to gauge success in this field of work. It failed miserably, because those who supervise the work done by therapists — who could best judge the quality and quantity of their work — seemed to feel they were rather uniformly successful on the job. No significant range of success was identifiable within the group of approximately 125 therapists for whom ratings were obtained.

Until adequate criteria become available, or until they are developed by methods requiring the expenditure of considerably more time and effort than it probably would be wise to spend, the scores earned on the Registry examination by applicants for registration with the ARPT may serve as one partial measure of success. This achievement examination has the advantage of being a *highly reliable* measure. Even for the quite homogeneous group of applicants the reliability coefficient (based on the Kuder-Richardson "foot-rule formula") is .89* for a random group of 200 cases. A further advantage is that scores of the examination are typically obtained right after formal training has been completed. The variable effects of experience, geographic location, adequacy of supervision, types of therapy performed, equipment available, and the like can have relatively little effect on this measure of competence.

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* This is a minimum value.

A major disadvantage of using the Registry examination as a measure of success is that it measures verbal knowledge of the field only. In the absence of other criteria, however, it would seem to be a useful assumption that therapists who know their field best should be better therapists than those whose knowledge may be more limited. To the extent that this is untrue, of course, the Registry examination may present a false picture of ability to work in the field. However, to assume that knowledge of the field and success in the field are unrelated seems untenable.

In the present investigation the total scores earned by 522 women and 286 men applicants to the Registry were compared. All were tested on the same form of the examination. Applicants trained at all approved schools were included; no selection of cases was made. Results of the investigation appear in table 1.

TABLE 1. — *Comparison of Registry Examination Scores Earned by Applicants of Both Sexes.*

	Female Applicants		Male Applicants
Number of cases	522		286
Average (mean) score	177.25		181.24
Difference between means		3.99	
Standard deviation	31.89		29.96
Standard error of mean	1.397		1.774
Standard error of difference between means		2.254	
"t" ratio (3.99/2.254)		1.767*	
"F" ratio (df 521, 285)		1.13*	

* Not significant at any usually acceptable level of confidence.

The statistic "t" is a ratio which, when compared with entries in standard tables of "t", enables the investigator to estimate the level of confidence with which he may accept or reject hypotheses about the groups under investigation. The data support the hypothesis that no significant difference between the sexes exists in so far as examination scores are concerned. Although the men applicants on the average score almost four points higher than the women, this difference could be attributable to chance factors sufficiently often to make assumptions about differences unwarranted. In other words the difference, as evaluated by usual significance tests, is not a significant one. This finding is, incidentally, typical of results obtained when measuring sex differences on many other kinds of verbal achievement tests.

It is sometimes felt that although perhaps the averages of two groups may be highly comparable, there might be much greater variability among the members of one group than among those of another. The "F" ratio provides a test of homogeneity of variances. Again, the data would indicate that the "spread" of knowledge of physical therapy as measured by the examination may be considered approximately equivalent for both sexes. This latter conclusion was further verified by testing the significance of differences between the standard deviations of the two groups by another formula described by Garrett.

Summary

In summary, then, it has been demonstrated that men and women therapists do not differ significantly with reference to the professional knowledge they possess if they are tested at a time when the maximum number of variables which could make for differences is controlled. Of course, it possibly may be shown that in their performance on the job, evaluated after they have had experience, either sex may be superior to the other. If this is demonstrated, the subsequent superiority must relate to factors which operate after academic training is completed or to factors which are unrelated to academic training.

It may well be that so-called "personality" factors — difficult to describe or isolate, often existing almost solely in the eyes of the beholder, and usually virtually impossible to quantify or classify — may be of considerable importance to effective work in physical therapy. On purely theoretical grounds, however, it is to be expected that sex differences of this sort may not be clearly definable. Psychological research has demonstrated that for many variables differences among people in each sex are so much greater than differences between sexes that sound conclusions with reference to sex differences are difficult to establish.

The task of demonstrating superiority of one sex in comparison with the other, at whatever point in time after training has been completed, will be an extremely difficult one. The research will require careful definition of conditions to be investigated, adequate control of variables, highly reliable objective criteria, the elimination of sources of bias, and ingenuity of a high order.

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THE NEUROPSYCHIATRIC ASPECTS OF REHABILITATION *

FRANKLIN G. EBAUGH, M.D.*

DENVER, COLORADO

Psychiatrists and specialists in Physical Medicine are working on common ground, as far as objectives and even to some extent methods, are concerned. In psychiatry the rehabilitation of the unhappy, inept, discouraged and incapacitated psychotic or psychoneurotic patient is basically the chief concern; in physical medicine the rehabilitation of the physically crippled. Yet in both fields we are practicing a "comprehensive" type of medicine, utilizing techniques based as much on the art of medicine as on the science. Thus, as Howard Rusk[1-2] has put it in talking about this "third phase of medicine," we are both trying to help a human being "to live and work with what he has left," or, as is frequently the case in both fields: to live and work effectively without some of the faculties the normal person takes for granted. In some fields of medicine it is possible to treat only the patient's illness, letting the patient himself recover as best he can. An appendectomy performed by a surgeon who never again sees the patient may be very successful, and the patient is soon back on his feet. But in physical medicine and psychiatry we are particularly concerned with helping a sick or injured person recover from a long standing disability. And if we are going to work successfully in these fields our concern has to be the individual, more than his disease per se.

What, then, are the emotional problems the chronically ill or injured person has to face, and what effect are they likely to have on his rehabilitation? First are the problems that arise from the original impact of the illness or injury. Clinically this is where rehabilitation begins. If we wait until recovery is well underway before we start to work on rehabilitating our patient, not only do we lose valuable time but we may be faced with habits and attitudes which have developed during the early phases of hospitalization which make ultimate rehabilitation impossible or at best incomplete. As Karl Menninger[3] has phrased it, "Rehabilitation begins at the gate of the hospital." Thus, an amputee is not left to his own devices until his stump recovers sufficiently, and then suddenly taken out of bed, fitted with a prosthesis, and sent home. From the very beginning he is prepared physically and emotionally for ultimate rehabilitation. Actually Menninger's statement is only partially true. The ground work for successful rehabilitation is often laid years and decades before the onset of illness or injury. Success depends to some extent on the crippled person's inherent resources, physical and mental — on his capabilities before injury, capabilities arising from the way the patient was brought up and the way he learned to face new situations and traumas. These are factors beyond our immediate control, but they may be decisive in the outcome.

This brings us back to consideration of the original emotional impact of a disabling injury or illness on the patient. Destruction of a body part or loss of specific abilities may give rise to tremendous fears, often apparently out of all proportion to the loss. Different people may react to the same injury in entirely different ways, depending largely on their previous life experiences. A self-centered school teacher may react to the loss of a leg much more adversely than a Colorado cowpuncher, even though the school teacher may retain his means of making a livelihood and the cowboy lose his. Thus arises the necessity for considering each person as an individual, reacting to trauma in his own individual way.

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* From the Colorado Psychopathic Hospital, University of Colorado Medical Center. Read before the 29th Annual Session, American Congress of Physical Medicine, September 5, 1951.

[1] Rusk, H., and Taylor, E. J.: New Hope for the Handicapped, Harper Brothers, 1949.

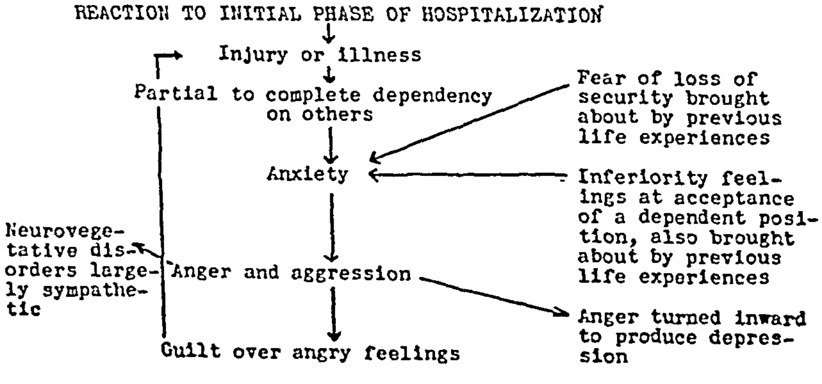
[2] Rusk, H.: The Broadening Horizons of Rehabilitation and Physical Medicine, J. A. M. A. 30:26, 1949.

[3] Menninger, K. A.: Mental Patients Predominate Here, Hospitals 20:44, 1946.

The prospect of long weeks and months in bed, the expense, the worries about one's family and other problems will give rise to tremendous anxiety in even the well integrated individual. To be completely dependent — to be actually at the mercy, as it were, of the physician, the physiotherapist, the nurse, may give rise to conflicts in the best adjusted of us. In growing up we learn how to deal with our need to depend on others, as we slowly emancipate ourselves from our parents we develop patterns of mutual dependency —on wives, husbands, children, associates. Most of us solve these problems fairly satisfactorily. But what happens when one is suddenly thrown into an almost infant-like situation of dependency? I believe this will be more clear to you if you think back on your own illness experiences, minor though they may be: how upset you were when the nurse neglected your morning bath, or the orderly forgot to remove your bed-pan, or your physician gave you an evasive answer, or failed to appear when you expected him. It goes almost without saying that a person suddenly thrown into such a position is going to become a very difficult management problem unless handled with consideration and understanding. To be dependent on someone who seems disinterested or who blows hot and cold can give rise to tremendous fear and anger which may stand in the way of the patient's progress.

One of the great problems faced in rehabilitation is the maintenance of a cooperative relationship between patient and physician, patient and therapist, and others, over long periods of time. Thus arises the necessity of starting out right with the patient. No time is more important in establishing this relationship than in the inital stages of his illness. A common mistake at this period is to appear too busy to be able to spend any time with the patient. This is particularly bad at the time of the initial contact, at the time of the patient's admission to the hospital. To allow him to talk frankly with you, to discharge some of his pent-up feelings, may do a great deal to cement the relationship which will give him the willingness to carry on toward recovery despite disheartening setbacks. I think we are all aware of the importance of the doctor-patient relationship and the same thing applies to the physiotherapist — patient or nurse — patient relationship. It is not necessary to talk in terms of transference and counter transference, as we do in psychiatry to appreciate the importance of this. An outline of some of the

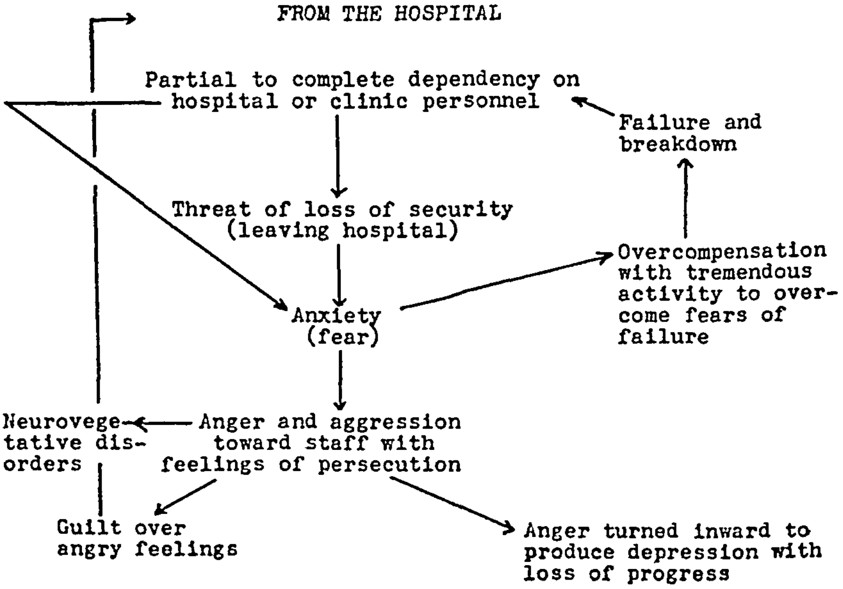
REACTION TO INITIAL PHASE OF HOSPITALIZATION


Injury or illness
Partial to complete dependency on others
Fear of loss of security brought about by previous life experiences
Anxiety
Inferiority feelings at acceptance of a dependent position, also brought about by previous life experiences
Neurovegetative disorders largely sympathetic
Anger and aggression
Anger turned inward to produce depression
Guilt over angry feelings

difficulties occurring during the initial phase of hospitalization might be made as follows:

I now skip over to the opposite end of the hospital period — the time before discharge, when we find our patients faced with other problems. Actually, if the patient has been well handled initially these problems may be quite minimal. If we have handled things poorly, they may interfere critically with a successful outcome. A great many patients have come to depend on the security of the hospital and the relationships they have made there. Frequently these relationships have been more satisfactory than any before their illness. Thus, many conflicts may arise in a patient facing the prospect of again returning to the outside world with all its competitions, lack of appreciation of the handicapped person's problems and lack of special attention. The patient may react to this conflict between desiring to be independent again vs. desiring to remain dependent and secure in the hospital in a number of ways: (1) He may become extremely angry toward the people he fears are rejecting him. The reasons behind his anger may not be readily apparent to him. He may feel vaguely persecuted and view attempts to rehabilitate him as a desire to get him out of the hospital to make bed space for others, or because the doctors have given up hope of really helping him further. (2) He may suddenly stop progressing and even fall back. This may be due to turning his anger against himself which usually results in depression. (3) He may develop all sorts of vague somatic complaints. Very frequently these will be related to his injured parts and prosthesis. On the other hand they may take the form of vague malaise, headaches, dizziness, weakness, etc. (4) Occasionally we may see a patient who overcompensates for his anxieties about leaving and his fears of failure. He pushes himself unmercifully and sets impossible goals. He may also set unrealistic vocational plans for himself and be upset because he is not encouraged in these. This type of over-reaction can be handled to advantage, but we should be on our guard against viewing it as normal and healthy. It may lead to discouraging set-backs. In people with tuberculosis it is a reaction that often leads to early and serious breakdowns. A summary of some of the reactions to this phase of separation from the hospital may be outlined as follows:

REACTION TO PHASE OF SEPARATION OF THE PATIENT
FROM THE HOSPITAL


Partial to complete dependency on hospital or clinic personnel
Failure and breakdown
Threat of loss of security (leaving hospital)
Overcompensation with tremendous activity to overcome fears of failure
Anxiety (fear)
Neurovegetative disorders
Anger and aggression toward staff with feelings of persecution
Guilt over angry feelings
Anger turned inward to produce depression with loss of progress

It should be emphasized that these reactions to the prospects of leaving the hospital are generally not conscious attempts on the patient's part to sabotage rehabilitation. For the physician to react to them in that manner makes him as unreasonable as the patient showing this behavior. Actually, these reactions are not unlike those of a child learning to grow up. They are neurotic, yes, in the sense that they are unrealistic; but they are readily understandable in terms of child-like behavior. In treating the neurotic we are in many ways treating the child in the adult. And so it is here. We are dealing with childlike and largely unconscious reactions to threatened loss of security; that is, to separation from the hospital. If we remember this and react accordingly, we can readily help our patients to grow up, and to understand and overcome these psychological pitfalls in the rehabilitation process.

This leads to my main theme: that most of these psychological problems in rehabilitation of the physically handicapped are readily understandable and can be best handled by the physicians and therapists in immediate charge of the patient. After all, it is easier for a patient to confide in those he has known and in whom he has confidence, rather than in a third person — a stranger. When psychological problems arise, as they inevitably do, there is usually no need to rush the patient to a psychiatrist. That is carrying specialization to an absurd extreme, and it is not doing the best thing for the patient. He may interpret it as meaning that the doctor is fed up with him, doesn't understand him or is trying to pass him off on someone else. When this unhappy patient gets to the psychiatrist he is an almost impossible problem to handle. Thus, what could and should have been handled effectively by the physician in charge has suddenly become an impossible situation — a vexing problem for the patient's doctor, the psychiatrist and most of all for the patient.

By this I don't wish to imply that there are not patients who should receive specialized psychiatric attention; of course, there are. The point I do wish to make is that a good working relationship between the patient and his doctor and therapist is the most satisfactory answer in most cases. For this reason it is frequently preferable to work, as psychiatrist, through the physicians and physiotherapists and social workers on the service. Coleman, Hurst and Hornbein[4-5] have aptly called this "staff-centered" psychiatric service. Thus, if the psychiatrist can be readily available to discuss day-to-day psychological problems of patients with the staff of a rehabilitation service as well as attending staff conferences and rounds to offer suggestions, a great deal more can be accomplished, not only for the patient's good, but also from the standpoint of training the newer personnel in problems of practical psychological management.

In discussing the problem of handling the rehabilitation of the chronically ill and injured the social worker is important. Not only can the worker be of great help in aiding the patient in dealing with pressing financial and family problems but in this same capacity may be of tremendous value in helping the patient in handling his psychological problems, many of these connected with these outside social and financial difficulties. It may actually be the social worker who will, by his close initial contact with the patient, recognize the need for more extensive psychiatric care for the patient, long before his psychological difficulties have shown up clinically to complicate the rehabilitation program. Thus, in a smoothly functioning program a certain amount of preventive or prophylactic psychiatry may be practiced.

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[4] Coleman, J. V.; Hurst, A., and Hornbein, R.: Psychiatric Contributions to Care of Tuberculosis Patients, J. A. M. A. 135:699, 1947.

[5] Hurst, A.; Coleman, J. V., and Hornbein, R.: The Place of Psychiatry in the Program of a Tuberculosis Hospital, Dis. of Chest 15:581, 1949.

As has been indicated, there are some patients whose psychological problems are deep-seated and disabling that they will require the direct services of the psychiatrist. When this is the case it is of greatest importance to have the referral properly made. A poor referral may destroy completely the chances of giving the patient adequate psychiatric care. A few worthwhile suggestions are: (1) Give the patient a chance to talk to you concerning his emotional problems and then, after indicating your understanding of his difficulties, the suggestion of psychiatric care may be offered. (2) It is important not to make a forced referral. Indicate it is something you feel advisable for the patient's welfare, but not mandatory. (3) Try to show the patient your continued interest so that he doesn't interpret referral as a "brush-off." (4) Give him a chance to express to you his ambivalent and often angry feelings about being referred. Don't shy away from accepting his anger and dealing with it. It is thus obvious that an adequate referral can only come from a physician who already has a good understanding of the patient and a close working relationship with him. From our standpoint we can help by talking with the referring physician before discussing the advisability of referral and suggesting special means of handling it. We can also be helpful by working closely with the rest of the rehabilitation team on the wards, during rounds and in the clinic, so that the patients themselves come to see that the psychiatrist is really just another member of the team.

Working with the physical medicine specialist in this common sense and straight forward manner, psychiatrists can contribute concretely toward helping the chronically disabled to a more complete and successful rehabilitation.

Discussion

Dr. George G. Deaver (New York, N. Y.): It is most gratifying to be asked to discuss this down-to-earth, practical presentation by Dr. Ebaugh.

I don't think there is any doubt in the minds of any of us who have been working with rehabilitation, concerning the importance of treating the emotional traumas of the disabled people as well as the physical disability. We must do this if we are to have any successful rehabilitation program.

Dr. Ebaugh emphasizes the importance of starting rehabilitation early. We frequently see the results of failure to do this, especially in our hemiplegia patients. We will have a married man who has suddenly had a stroke. His whole picture changes, when he is taken to a hospital, where the nurses wait on him. His wife's whole attitude changes, and she immediately says, "What can I do for you, John?" After a few weeks the patient is sent home with instructions from the doctor to take it easy.

To start a rehabilitation program at that point is very difficult, because the patient thinks, "This is wonderful. My wife is waiting on me; my married children, who never came to see me, now come to see me every week. What's the use of getting well."

If we start our programs early so that the patient thinks that rehabilitation is simply a part of our rehabilitation program, many of these emotional problems can be overcome The suggestion that Dr. Ebaugh made, that the prospect of long weeks and months in bed, and the expense, and the worry about one's family, and other problems giving rise to tremendous emotion, are facts that all of us must realize.

One large insurance company is now hiring physical therapists, nurses and occupational therapists as liaison officers of the company. As soon as a man has an injury they visit the family; they visit the man in the hospital, and his employer, and tell the patient that the problems at home are taken care of, and that compensation is now being paid to the family. They arrange for a visit from his boss, and the boss wants to know how the man is and when he can come back to work. They are all planning a rehabilitation program for him.

This type of service is another thing that can relieve him of his emotional problems.

In any program of rehabilitation, when we try to teach people to do something for themselves — to walk and take care of themselves and regain their speech, mutual activity should be stressed. I like the 3-A slogan that we use so much: Action Absorbs Anxiety. If we can get people out of bed and on their feet, have them start doing things for themselves, and work with them, to convince them that we are interested, much of their anxiety can be overcome.

I should like to emphasize the point Dr. Ebaugh made, that the best method of utilizing a psychiatrist is to have him available from day to day to discuss the psychological problems of patients with the staff, and that this is the best method of handling the psychological problem.

We have found that true in our Institute of Rehabilitation, where we have a full-time psychiatrist. Every time we evaluate a patient he is the one who tells us about the problems of the individual concerned. He can tell us methods of handling cases of the malingerer — the person who has an hysteria, a neurotic patient, or whether we are dealing with a psychotic patient. We have been told several times that we should not even try to rehabilitate a patient of a disability, because of the psychological problems and personality; if you treat the disability and cure him, he will develop something that may be much worse.

Having a psychiatrist around to help out and to point out how we should handle our patients is important. I wish to thank Dr. Ebaugh for bringing to our attention the place of the neuropsychiatrist on the rehabilitation team, for emphasizing that the physiatrist and therapist, who have the immediate charge of the patient, with proper guidance can best handle many of the psychological problems which may arise.

Dr. B. L. Boynton (Houston, Texas): For over a year at our institution we have had an attending neuropsychiatrist as part of our rehabilitation staff. The psychiatrist and the clinical psychologist, working together with us as a team, have given us basic fundamental information regarding our attitude toward the patient, which in my opinion is of great importance; then they have helped us to understand the patient's problem from his point of view, which is most important.

I would like to take this occasion to brag. There are three physicians on my staff, and for the past ten months there hasn't been one patient at whom we have gotten "mad." I think that is an accomplishment that we owe to the psychiatrist.

EXERCISES FOLLOWING THE BANKART OPERATION FOR RECURRENT SHOULDER DISLOCATION *

J. L. RUDD, M.D.†
WEST ROXBURY, MASSACHUSETTS
and
E. F. HAYDOCK, R.P.T., B.S.‡
CHELSEA, MASSACHUSETTS

The object of the study represented by this paper was to determine whether postoperative exercises for recurrent shoulder dislocations had resulted in an earlier increase in the range of shoulder motion, greater improvement in gains in strength and a decrease in the length of the average recovery period in comparison with cases which did not receive similar supervised activity.

In the Naval hospital patients were returned to full duty immediately after hospitalization was completed. An accelerated activity schedule was given them after the Bankart* operation. This took place under closer supervision and for a longer time than was permitted for patients of the non-military institution which were used for comparison.

In the military hospital about two and one-half weeks after operation the Velpeau bandage was removed and the patient was given his first shoulder activity on the ward. Codman's stooping exercises were started. The principle of these exercises[1] is that they allow the patient to abduct the arm with the aid of gravity and so need no fulcrum either on the glenoid or the acromion or both. Since, in the stooping position no fulcrum is necessary, either lateral or antero-posterior motions can be done with a pendulum-like movement without much muscular effort. In this position the weight of the arm actually helps to stretch the contracted tissue of the shoulder joint.

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† Sponsored by the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the authors are a result of their own study and do not necessarily reflect the opinion or policy of the Veterans Administration or the Medical Department of the Navy.

* Read at the Twenty-Ninth Annual Session of the American Congress on Physical Medicine, Denver-Colorado, September 6, 1951.

† Chief, Physical Medicine Rehabilitation Service, Veterans Administration Hospital, West Roxbury, Massachusetts [illegible] sical Medicine Rehabilitation, Chelsea Naval Hospital.

‡ Chief, [illegible] Chelsea Naval Hospital.

* Bankart, A. S. B.: Operation for Recurrent Shoulder Dislocation, Brit. M. J. 2:1132.

[1] Codman, E. A.: The Shoulder. Thomas Todd Co., Printers, Boston, Mass., 1934, p. 202.

A series of sixteen cases, at the Naval hospital, were referred to the Rehabilitation Section only 3.4 weeks after operation for the recurrent dislocations. A series of 24 cases, from the non-military hospital, were not exercised under supervision in a Physical Medicine Department.

In the non-military group the patient left the hospital as soon as the wound had healed and the stitches were out. General shoulder exercises were advised, on an out-patient basis, on an average of 4.4 weeks post-operatively. The individual would report back to the follow-up clinic for examination and instruction regarding the type and extent of activity. Since the main objective at this hospital is to get the patient out after operation as quickly as possible, with maximum benefit, a shorter stay is imperative and little or no daily, progressive, supervised corrective therapy can be administered.

In the military hospital the sixteen cases were given early and intensive work on a definite exercise program. The importance of full range of motion was first stressed and then increase in the strength of the shoulder joint musculature was sought. In comparing the results of those who had the exercises with those who had no definite plan or supervision it was found that the former regained range of motion and strength sooner and returned to duty earlier. After three weeks in physical medicine activities most of the supervised group could raise 50 to 75 pounds or more over their heads with the "two-hands press." The patients on a definite program were sent to the corrective therapy section earlier and, on the average, it required less than *two and a half months* after the operation for them to reach a maximum range of motion. They were able to return to full duty. This is compared to an average of *five months* for those who were not on a definite planned program.

The military patients who were exercised daily, reported to the Rehabilitation Therapy Section wearing a simple sling. At this time the initial comparison measurements were taken to determine the range of shoulder motion. The routine Codman stooping exercises had previously been started on the ward by the orthopedist, about two and one-half weeks postoperatively. Following this, in the Physical Medicine Department, heat, massage, the Hubbard tank and increased pendulum activity, with the addition of other shoulder

Fig. 1.

exercises, were stressed for at least one-half hour in the morning and one-half hour in the afternoon.

Outline of Activities

First Ten Days. — Codmans' stooping exercises. Hubbard tank for relaxed swimming strokes. Hand exercises with both hands. A ceiling pulley for active assistive exercises. Shoulder exercises with light weights. Shoulder wheel without resistance. Shoulder ladder. Floor pulley (Fig. 1) supine, on a plinth, with stretch in elevation, abduction and external rotation to tolerance.

Tenth to Twenty-First Day. — Resistance bolt on the shoulder wheel is tightened. Supervised punching bag exercises are begun. Wall pulleys with weights are used. Later, increased activity with Sargent weights, the punching bag and weight lifting is stressed.

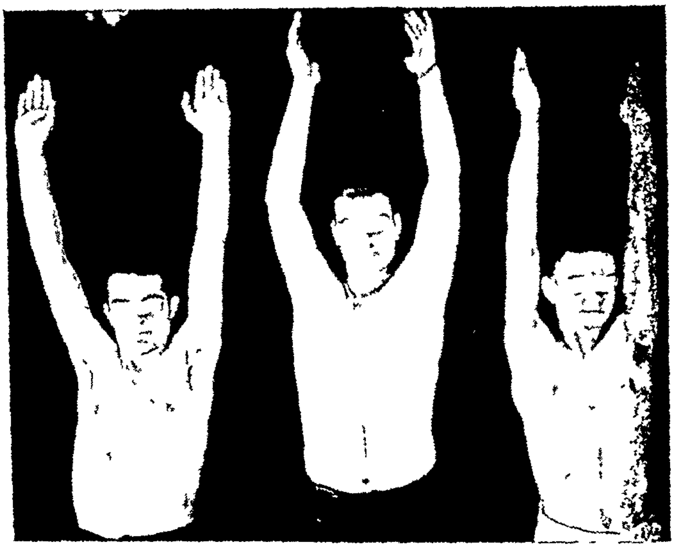

Fig. 2.

By the end of the fifth week many of the patients can lift from 50 to 100 pound weights over their head and do many push-ups. They have strong forward flexion, fair abduction and external rotation and the expected good internal rotation (Fig. 2).

Comment

It can be safely stated that most individuals sent home to do postoperative shoulder exercises do not do daily, progressively increasing, activity. They neglect many of their exercises and substitute muscles that are not to be used. They have no facilities for wall or ceiling pulleys or the other useful equipment found in most well equipped physical medicine departments. They fail to remember many of the instructions given them describing motions needed for increasing and strengthening the shoulder girdle.

An outstanding example is a patient who was told to exercise but who stated (after more than ten months had elapsed since a Bankart operation) that he did not know he was supposed to raise his arm over his head. He had had the impression that he was to carry the arm down and "always to favor it."

Many of the patients were seen and treated in the rehabilitation section. Much of the information that was gathered was evaluated from hospital records. A sincere effort was made to have the conclusions drawn as fair and as statistically correct as possible.

Summary

A group of sixteen cases exercised, under supervision, and a group of twenty-four cases advised to exercise, on an out-patient basis, were studied. The former group were sent to a physical medicine department earlier for treatment and were returned to duty earlier. It took only two and a half months for return to duty by the supervised group compared to five months for those individuals who were told to do shoulder exercises at home.

A planned program of supervised activity in postoperative Bankart cases resulted, in sixteen of our series of forty cases, in better shoulder motion and strength as well as a quicker return to duty than "exercise-advice" without daily supervision.

Discussion

Dr. W. B. Snow (New York City): The authors of this paper have brought to the fore several important facts which are always a consideration in post-traumatic joint rehabilitation. The earlier the mobilization can safely be instituted the faster and more complete will be the re-establishment of range of motion and muscle power. In any exercise therapy there should be a definite plan of treatment, a definite goal, and an orderly progressive sequence of exercises stepped up consistent with return of function. The patient should be told the reason and the plan for this exercise therapy. Best results in traumatic injury are to be obtained when an integrated plan between the surgeon and the physical medicine service is arrived at. Also it is important to know the extent, the pathology, and mechanism of the injury, and the surgery performed, if physical medicine is to be applied most efficaciously. In the case of recurrent dislocations of the shoulder, there are several types of operations which are popularly used. These are mainly repair to reduce laxness of the capsule of the joint and retain the humeral head in the glenoid fossa. These operations are such as the tenosuspension procedure in which section of the perineus longus tendon is threaded through holes drilled through the acromion and the tuberosity of the humerus. In the Cole operation where the tendon of the long head of the bicep is utilized and passed through a hole drilled diagonally upward through the humeral tuberosity, shortened and secured, with suspension of the humerus. The Bankhart operation is based upon the concept that in most traumatic dislocations of the shoulder as the humeral head descends during the dislocation the capsule is torn with or without fracture of the glenoid labium from the anterior portion of the glenoid cavity. The shoulder capsule itself is unusually lax and depends for strength on the synchronized muscle folds about the shoulder. The weak portion, and the one where rupture usually occurs, lies between the insertion of the subscapularis and the origin of the triceps on the lower glenoid margin. Recurrent dislocations are most common when the shoulder is extended, pronated, and abducted at one time as in reaching the extended arm over a barrier. Likewise, these may occur if the arm is in such position as is assumed in hanging on a bus strap, and some external rotation is produced when the bus lurches. The Bankhart operation is a more formidable procedure than the others mentioned. It consists of sewing the detached glenoid lip back in place along with the capsule to the lower glenoid margin resulting in a very complete repair. In orthopedic circles in recent years, there has been a gradual increase in the number of such procedures carried out. Not to detract from the authors' work, I would say that they start out on their exercise routine with a distinct head start to good function due to the Bankhart operation procedure. The exercises as, in tendon repairs, are not started until the danger of gelatinous union is passed. The authors have accumulated a well worked out group of exercises to accomplish their ends. These exercises strengthen the subscapularis, teres major, anterior deltoid, pectoral major, latissimus dorsi. Bowling might be added as a reasonably early recreative exercise and the use of golf clubs would likewise be reasonable as soon as range of motion is better established. Neither of these, if we analyze the kinesiology, would carry much hazard. Comparison of these two groups of cases stresses the importance of coordinated interest of the surgical and physical medical services. It is interesting that no consideration was given in any of these cases to brachial plexus injuries in shoulder dislocations.

Dr. Rudd (closing): Dr. Snow filled in with a lot of information that I omitted (which was important) but for which I did not have time. I want to bring out this point: many of the exercises are standard shoulder procedures which have proved useful, for example, in cases of bursitis, after reductions of fractures, etc. The chief stress in this paper is on the rapidity of the progression of the exercises and on the opportunity to compare the results of those who had received and those who had not received this activity under supervision.

At a symposium on "Recurring Shoulder Dislocation," presented before the British Orthopaedic Association in London, October, 1947, Dr. Reginald Watson-Jones said that there was only a single failure in 52 operations and he felt that was due to a superior approach to the shoulder instead of the anterior exposure, capsular reefing, and shortening of the subscapularis muscle. He said that the success of the Bankart operation depends not only on repair of the labrial defect but on necessary resuture of the capsule. Thus the capsule is shortened and external rotation is limited.

J. Crawford Adams, at the same symposium, said that the average range of external rotation is 51 degrees and abduction is 166 degrees. This is of especial interest since it has been said that unless there is full external rotation of the humerus it is not possible to do more than 90 degrees of abduction.

NEW DEVELOPMENTS IN AMPUTEE REHABILITATION*

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It seems rather ironical that most advances in amputation surgery and in the development of prosthetic devices in modern times have taken place during and immediately following a major war. The casualties resulting from the Civil War gave great impetus to the development of the artificial limb industry and led to the establishment of many small artificial limb shops, usually conducted by amputees themselves.

Renewed interest in amputations occurred in World War I and led to many new developments. Norman H. Kirk's efforts to improve the care of amputees were well recognized and eventually led to his appointment as Surgeon General of the Army, in which capacity he inaugurated the outstanding program of amputee care in World War II. This included the policy of doing only open, or guillotine amputations, in field or station hospitals, postponing all definitive surgery such as stump revisions or closed amputations at the site of election to be done only in established amputation centers by skilled, experienced surgeons. Thus much valuable limb length was saved, and often many a life. In addition, an adequate program of after care, including prosthetic fitting, training and other rehabilitation techniques was established in these military amputation centers.

Rehabilitation of the amputee can be divided into four phases, each of which constitutes an essential step in the successful use of his prosthesis and in adjustment to his handicap. The various procedures essential to these four steps represent the combined talents of many highly trained and experienced persons, including physicians, nurses, training therapists, limb makers, social workers, vocational counselors, all working as a team in a closely integrated program designed to speed recovery of the amputee and his return to normal living.

The four phases are (1) surgical considerations, including immediate post operative care; (2) selection and fitting of the prosthesis; (3) training in use of the prosthesis; (4) emotional and social adjustment. In the past little attention has been paid to most of these considerations by the medical profession and even now they are little understood and often neglected.

Surgical Considerations

The final condition of the stump plays a very important part in the successful fitting and use of the prosthesis; the surgeon in planning and performing the amputation should give careful consideration to the functional and prosthetic requirements of the stump, choosing the optimum site of amputation and fashioning the stump end in a manner best suited for efficient and comfortable use.

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* Read at the Twenty-Ninth Annual Session of the American Congress of Physical Medicine, Denver, Colo., Sept. 6, 1951.

It is often evident that certain difficulties encountered in prosthetic fitting might well have been avoided by a more thoughtful consideration and analysis on the part of the surgeon at the time of amputation of the prosthetic requirements of the stump. For example, the above knee stump best adapted to the fitting of the suction socket should be cylindrical rather than conical in shape, and the aponeurosis and tendons of apposed severed muscle groups should be loosely sutured over the bone end rather than being allowed to retract.

The after-care, which includes the preparation of the stump for the prosthesis, is most important and is often neglected by the surgeon. The stump, which at first is swollen, flabby and bulky, must be remodeled and shrunk by proper bandaging until it is firm and tapering. The bandaging technique must be carried out meticulously, for if faultily done it is worse than useless and may even do harm. Also an essential part of the preparation of the stump for the prosthesis is a rigid program of daily exercises to improve muscle tone and body balance and to prevent contractures and deformities. Failure to carry out these important postoperative procedures results in prolonged and unnecessary delay in fitting the prosthesis and may even permanently handicap the amputee in efficient use of his prosthesis.

Selection and Fitting of the Prosthesis

The physician has a real responsibility as to advising the amputee in selecting his prosthesis, in supervising its fitting and in directing training in its use.

Within certain limitations there is a much wider range of selectivity in artificial limbs than is generally realized, and it is most important that great care and judgment be exercised in advising the amputee in his selection. Each amputee offers an individual problem and many factors must be taken into consideration other than the site of amputation: age, sex, physical condition, education, occupation, social and economic status, and mental attitudes are all important considerations.

The loss of a limb is often followed by a feeling of extreme frustration and most amputees need some help in combating this situation. The amputee must be encouraged in every way, and the possibilities of leading a normal life should be emphasized; but he must also face the situation realistically and make every effort to adjust himself to his handicap. He should be encouraged by all means to secure a prosthesis, properly selected for his individual needs, and to persevere in learning to master it. On the other hand, it is a serious mistake to promise too much. Great damage is done by arousing false hopes and promising results that can never be attained. Never should the temptation to encourage or cheer an amputee go to the length of leading him to think that he can achieve something that may be impossible for him. It is essential therefore, that the many limitations of the prosthesis as well as its possibilities, be carefully pointed out to the amputee frankly and clearly at the very beginning. Great harm has been done in the past by well-meaning, but over-zealous and exceptionally skilled limb-wearers who demonstrate amazing feats far beyond the capacity of the average amputee, thus fostering the mistaken hope that the new amputee can do the same.

Instruction and Training

Only in recent years has the importance of training the amputee in the use of his prosthesis been appreciated. With the lower extremity amputation, not only are active exercises necessary but careful instruction and persistent practice in proper gait and posture are essential. This is designed to prevent muscle and joint contracture and deformity, to increase muscle strength and develop coordination and balance. With the upper extremity prosthesis, the amputee requires thorough instruction, long practice and perseverance if he is to master its use. The artificial arm is only a tool and the *amputee must learn to use it as one learns to use any sort of tool. No prosthesis*, no matter how skillfully constructed or fitted, ever functions by itself; its value lies entirely in the ability of the amputee to learn to use it. Great advances have been made recently in the development of new training techniques for both upper and lower extremity amputees.

Research and Development

The Committee on Prosthetic Devices (now called the Advisory Committee on Artificial Limbs) was established in April, 1945, by the National Research Council at the request of the Surgeon General of the Army. The function of the committee as stated was:

> The inauguration and administration of a program of research and development aimed at the improvement of artificial limbs.*

This marked a most significant advance as the need for fundamental research in this field was well recognized by both the limb manufacturing industry and the medical profession. As stated by Dr. Craig Taylor — "the whole program is dedicated to the premise that the amputee shall have the best devices possible from the standpoint of function, comfort and appearance." The research studies have included chiefly two basic projects, namely: (1) Fundamental studies pertaining to gait, motion, and other phases of muscle physiology as related to amputations, and (2) Development and improvement of prosthetic devices.

New Devices

Some of the more important devices which have been developed to the point where they have been released by the committee and made available to the limb industry are briefly described as follows:

Suction Socket. — The suction socket above-knee prosthesis, first developed in Germany, differs from the conventional leg in that it has no pelvic hinge or suspension harness. The leg is held on by moderate suction created in the closed socket each time the leg is lifted from the ground, plus the friction produced by the contracting muscles of the stump against the sides of the socket. It is a truly stump-controlled prosthesis; obviates the discomfort and inconvenience of the pelvic hinge and belt, feels more like an integral part of the body, and permits greater freedom of motion in all directions. Accurate fitting and alignment are indispensable for its successful use, and intensive instruction and training in its use are most desirable. Generally speaking the properly fitted suction socket prosthesis is unexcelled for the above-knee amputee and represents a great advance in prostheses for amputations of the lower extremity.

Artificial Arms. — Material advances in the design and construction of upper extremity prostheses have been made by the A. C. A. L. Construction materials, such as low-pressure laminated plastics and light weight aluminum alloys, have been carefully tested and selected for their maximum strength and minimum weight characteristics. The plastic sockets are molded over plaster of paris models of the stump, carefully fashioned so that the finished socket accurately fits the contours of the stump with comfort and stability.

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* Research Reports on Artificial Limbs. Committee on Prosthetic Devices, National Research Council, Evanston, Ill., 1946.

In the above elbow prosthesis, the new types of mechanical elbow joints equipped with shoulder-shrug actuated elbow-locking mechanisms, and a turntable which permits rotation of the forearm section about the long axis of the stump, also represent some of the new devices that are of great advantage to the upper arm amputee. Careful studies have also been conducted to determine the most efficient methods of harnessing and control of the prosthesis, with great benefit to the amputee. Only recently has the importance of proper harnessing been recognized.

Terminal Devices. — These are so called because they attach to the end of the prosthesis and substitute for the hand. Those in most common use are the light dress, or cosmetic hand, which has little or no function, and the mechanical hand and utility hook; both of these have grasping power activated by muscles elsewhere in the body, usually from the opposite shoulder. They are controlled by webbing harness and cables of metal, leather, or nylon.

A recent advance, developed under the auspices of the A. C. A. L. for control of the terminal device, is the use of a stainless steel cable encased within a stainless steel spring-wound housing. This cable has many advantages over the conventional leather thong control used in the past.

These mechanical hands and hooks are of two general types, differing from each other in the mechanism of the opening and closing device. One is called the "voluntary closure" or "voluntary-muscle-control" type, in which the fingers are held open by a light spring and are closed by voluntary muscle control through the harness and cable. The other type, which is termed the "voluntary opening" or "spring tension," is held in a closed position by means of a strong spring, or, as in the case of the conventional hook, by means of rubber bands passed about the base of the two fingers, and is opened by tightening the control cable.

The Army Prosthetic Research Laboratory has developed a new hook and a new hand, which appear to have certain definite advantages over the conventional devices now in common use. They are of the "voluntary closure" type and are interchangeable on the wrist plate of the prosthesis so that either can be worn as desired. They are equipped with a self-locking device, or clutch, which allows the fingers to be closed and locked automatically in any position and with exactly the required tension necessary to grasp the object firmly. This allows a very accurate and delicate control in grasping objects of various size, shape and density. The first pull of the control cord closes the fingers, which automatically lock in position about the object grasped when the pull is released. The second pull releases the locking mechanism and the fingers then open automatically by means of a spring incorporated within a housing at the base of the terminal device. The APRL hand is covered with a special cosmetic skin glove which resembles to a fair degree the natural skin.

These represent just a few of the new devices being developed under the research program of the A. C. A. L. The program continues, and many new projects which promise much for the future are now under way.

Teamwork in the Rehabilitation of the Amputee

Another very significant improvement in service to the amputee is the development of a spirit of teamwork among those concerned with his problem. The surgeon is beginning to realize that treatment of the amputee does not end when the wound is healed, and is appreciating more and more the importance of post-operative preparation of the stump, the necessity of advising the amputee in the selection of his prosthesis and of supervising its fitting and training in its use.

More and more effort is being made to give therapists the opportunity to work with amputees so that they may gain experience in proper training methods in gait, posture and the most efficient use of the prosthesis. At the present time such experience is available only in a few well-organized rehabilitation centers. Vocational counselors, social workers, welfare and governmental agencies who purchase artificial limbs are beginning to recognize the necessity for careful selection of the device best suited for the amputee's individual needs, regardless of price, and for good fitting and training, instead of purchasing the appliance in the open market from the lowest bidder without consideration of indications or quality of service.

The prosthetic clinics recently inaugurated by the Veterans Administration furnish a good example of this sort of teamwork in action.

One of the most significant developments that has taken place in recent years is the commendable change in attitude and philosophy evidenced by members of the artificial limb industry. This has been demonstrated by the gradual development of a truly professional attitude toward their work and in their relationship with the physician and the amputee. More and more emphasis is being placed on rendering a service rather than selling a product. This change has resulted in an awakening sense of professional responsibility stimulating a keen desire for more knowledge and training. The voluntary establishment by the limb and appliance industry of a Board of Certification to set up standards of qualification and training for their members is a concrete example of this change in attitude. Through the impetus of this board and other far-sighted members of the industry and other interested groups, special schools and training courses have been conducted and enthusiastically attended by these craftsmen. As Chester C. Haddan* recently stated: "Never before has modern history seen a similar example of an entire industry going to school."

All of these advances are very encouraging and mark great progress in service to the amputee, but much more needs to be accomplished and the responsibility for this now rests largely with the medical profession. In spite of the improved prosthetic devices and advances in training techniques, and the increased interest in amputee care, a large number of physicians who perform amputations and care for them afterwards still manifest little concern in the problem and evidence a woeful lack of understanding and appreciation of the importance of proper care and supervision following amputation.

This deficiency constitutes a real challenge to the medical profession and can be solved only by improving our teaching methods. Organized courses including the study of prosthetic devices and orthopedic appliances as well as other rehabilitation techniques, should be added to the curricula of medical schools both on the undergraduate as well as the graduate level. Such courses. made up of lectures, clinical demonstrations, and even shop work under the direction of qualified appliance makers, should be required of all residents in orthopedic surgery, general surgery, and physical medicine. In spite of the tremendous advances made in rehabilitation of the amputee, not until medical schools accept this sort of teaching responsibility will the civilian amputee receive the type of care and service he deserves.

Discussion

Dr. Odon F. von Werssowetz (Nashville, Tennessee): Before commencing this discussion, may I express our indebtedness to Dr. Thomas for placing before us the benefits of his many years of experience in orthopedic surgery, especially in the amputation and prosthetic fields. His paper brings to us the new major developments in the field of the rehabilitation of amputees.

The rehabilitation process should start at or before the time of the amputation.

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* Haddan, C. C.: Present Prosthetic Practices, Jour. O. A. L. M. A., Washington, May, 1951.

When the amputation is carried out, it begins a completely new period in the life of the patient. He finds himself, rather abruptly, in a new position and unfamiliar circumstances. He is lost and helpless. He seeks guidance and needs complete rehabilitation. It is gratifying to note that the total rehabilitation of the amputee is being accepted as the ultimate goal of recovery. A few years ago, it was generally found that this goal was only the healing of the stump.

The total rehabilitation of the amputee, as Dr. Thomas so aptly expressed it, is the result of teamwork of numerous workers, each skilled in his own field, working together in harmony for the patient and with the patient to achieve the maximal functional, social, and vocational recovery of which the patient may be capable. It must be borne in mind that an amputee is a completely coordinated human being, who has lost a limb. He has certain complex and individual physiological, neurological, and psychological characteristics which are inherent to himself and govern his thinking and actions. The lost limb was a part of this process and was used in many voluntary and involuntary acts, which now he may lack. He has to develop new patterns, new reflexes, and new mental balance. To obtain successful results, it is essential that the physician or surgeon in charge prescribe the various procedures in a thoughtful and scientific manner. Because this rehabilitation process is slow, having numerous ramifications, it is becoming more acceptable that a qualified physiatrist, if available, take charge of the patient after final surgical procedures have been completed. This is especially true in our Service Hospitals.

As Dr. Thomas pointed out, there is an increasingly greater cooperation between the physician and the artificial limb maker. It is coming to be accepted that prostheses should be provided or sold by the limb maker only on a proper medical prescription. The objective of such a prescription is to fit the amputee with a prosthesis which will meet his requirements as completely as possible. This is especially important in the selection of an upper extremity prosthesis. The physician in charge of the case should make the selection. He cannot and must not delegate this to the limb maker. The physician should give accurate and detailed instructions. The limb maker, like the pharmacist, is highly skilled in technical matters but is untrained medically to evaluate all existing disabilities and to foresee possible complications. To obtain successful results, it is essential that the physician prescribing such a prosthesis have a thorough knowledge of the potentialities and limitations of each of the different types of devices available on the market, utilizing effectively all new improvements as they become of proved value. New or improved devices require new procedures in training. The physician should be familiar with them and prescribe such to meet the needs of the amputee.

The major effort in the development of new devices has been undertaken by the government's artificial limb program, under the coordination of the Advisory Committee on Artificial Limbs of the National Research Council, which is sponsored by the Veterans Administration. So far, the major achievements of this research are— the suction socket A/K prosthesis, the APRL hook and hand, a new type of upper extremity prosthesis, and new methods for their harnessing. The Air Force has sponsored work on the hydraulic knee. So far, this research is showing promising results. The soft socket for the below knee amputee gave excellent results on an experimental basis, but it still has to pass the field test. Though this effort is primarily intended to aid veterans or service men, eventually it also benefits the civilian amputee. It is worth noting that there are between 30,000 and 40,000 new amputees each year. These people need care and sound medical advice.

I thoroughly agree with Dr. Thomas that the medical profession as a whole manifests little interest in the problem of amputee care and lacks appreciation of total rehabilitation. Proper fitting and alignment of a prosthesis is still an art possessed by few, but this phase is the most important of the program. Successful management of this phase will greatly influence and determine the final outcome of the total rehabilitation program. It is obvious that a misfitted prosthesis, causing pain on each step, will limit the functional scope of the amputee, yet one sees such cases daily. The answer to this problem, as Dr. Thomas has emphasized, is to improve our teaching methods on the undergraduate and postgraduate levels in medical schools and centers. Such training should be and must be required for all residents in orthopedic surgery and physical medicine.

I would like to suggest that during each annual meeting of this Congress, at least one session be devoted to a symposium on the various problems of prosthetic and orthopedic appliances. These devices are encountered daily by the physiatrist in his practice, and he should be well versed in their use and application.

As a general rule, the physiatrist has a longer contact with the amputee and has the opportunity to see him under diverse situations during the training process. If any complications occur, the physiatrist should be able to correct them as they arise. The great majority of complications are caused by dynamic changes in the stump resulting in altered fit of the prosthesis. Therefore, it is imperative that the physiatrist have a thorough knowledge of fitting and alignment. In this connection, I would like to emphasize that it is not enough to see an amputee walk a few feet with his prosthesis or perform a few simple movements of the arm for evaluation of the fit. Proper evaluation requires a thorough observation, which necessitates repeated analysis of functional ability over a sufficient period of time. Only in this way can successful fitting be insured.

PATHOGENETIC CONCEPTS OF "FIBROSITIS" *

Fibropathic Syndromes

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"Fibrositis" is certainly not only a confused but also a confusing term. Therefore it is altogether preferable to use the term "fibropathic syndromes" to indicate the different non-arthritic rheumatic symptom-complexes of different etiology, pathology, pathogenesis, and clinical course.

The purpose of this brief summary of the more thoroughly elaborated pathogenetic concepts of fibropathic syndromes is two-fold: (a) To demonstrate that there is already adequate workable knowledge of the bio-chemical, bio-physical, neuro-physiological, and bio-electrical aspects of the fibropathic syndromes available to show that attempts at solving the problem from a histo-pathological aspect are a priori doomed to failure. (b) To stimulate more research in these lines in order to achieve a scientifically acceptable comprehension of this obscure but important ailment.

I. Neural Reflex Mechanisms

The concept of neural reflex mechanisms in the pathogenesis of fibropathic syndromes originated from two basic observations:

(1) *Any lesion* — visceral or somatic — may cause secondary (reflectory) pain, tenderness, spasm, and also actual lesion at a distant "area of reference."

(2) *This secondary lesion may* — in due time — assume the character and functions of an independent lesion producing symptoms and signs of its own.[1]

Although the distribution of referred spasm, pain, tenderness, and vasoconstriction does not follow recognized segmental patterns, it can definitely be ascertained that many fibropathic syndromes show certain patterns as to localization ("sites of predilection") not only of the primary but also of the secondary (referred) signs and symptoms.

The neural reflex concept is based on two neuro-anatomical and two neuro-physiological observations. The two neuro-anatomical observations are:

(A) Axon branching.

This explains referred pain as originating at a primary lesion but — *by faulty central localization of pain perception* — being projected to and localized at the terminal of another branch of a bifurcated sensory nerve axon. (Sinclair, et al.[1]) Evidence of this mechanism may be seen in the following observations:

(a) Procainization of the zone of reference does not abolish referred pain, while procainization of the primary lesion does.[2]

(b) Injection of saline solution into interspinous ligaments provokes pattern-like referred pain in a phantom limb.[2]

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* Read at the meeting of the Eastern Section of the American Congress of Physical Medicine on April 28, 1951.

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[1] Sinclair, D. C.; Weddell, G., and Feindel, W. H.: Referred Pain and Associated Phenomena, Brain 71:184, 1948.

[2] Harman, J. B.: The Localization of Deep Pain, Brit. M. J. 1:188, 1948.

(c) "Pain spreads from fingers immersed in cold water to adjacent anesthetized fingers." (Kunkle and Armistead.[3])

In all these instances, pain is being perceived in non-existing, or in anesthetized structures because of central misinterpretation of localization.

Persistent referred pain may eventually result in production of metabolites at the terminal of the secondary branch and cause referred tenderness and also actual referred lesion.[1] Evidence of this hypothesis can be seen in the following observations:

(a) Procainization of the zone of reference abolishes *referred tenderness but not referred pain.*

(b) Procainization of the primary lesion abolishes referred pain, but may fail to abolish referred tenderness if the referred tenderness has already assumed the character and function of an independent lesion with symptoms and signs of its own.

(B) Sensory Reflex Organization of the Cord.

A large number of neurons are said to be interposed between the posterior horn (i. e., sensory pathways) and the motor pathways in the anterior and lateral horns (somatic and sympathetic, respectively). These neurons represent an "internuncial pool" (Lorente de No[4]) which functions as a vast relay station between the incoming and the outgoing pathways of all segments in the cord. It can also sort out incoming sensory impulses and switch them to motor and sympathetic neurons over the entire cord and thus activate reflectory hetero- or multi-segmental responses. The selective function of the internuncial pool can also explain the fact that similar incoming sensory impulses may activate different pathways in different intensities at different times. (Gasser.[5])

"Potentially, activity entering the central nervous system by any given neuron-path is capable of influencing by more or less devious routes every other neuron therein." (Lloyd.[6]).

Through this complicated network, interposed between afferent pathways, incoming sensory impulses may initiate co-ordinated waves over one or more segments, thus stimulating a large number of motor and sympathetic neurons and inhibiting others and bringing about those poorly understood and often-times misinterpreted reflectory — sometimes labelled as "hysterical" — patterns.

Neuro-Physiological Observations

(A) It was demonstrated by electro-myographic studies that myalgic muscles are in a constant hyper-excitatory state even at rest. It is also known that minimal contractions can reflectorily be increased in magnitude by mild superficial sensory stimulation which in itself would be inadequate to provoke motory response in a resting, normal muscle. (Phenomenon of facilitation.)

Such a mechanism of facilitation can be accounted for many acute exacerbations of pre-existing, asymptomatic myalgic lesions provoked by various precipitating factors such as cold, trauma, infection, fatigue. Emotional experience strong enough to upset the normal physiology of the central nervous system may stimulate the same pre-existing, asymptomatic myalgic lesions.[8] ("Facilitation from above." Elliott.[7])

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3. Kunkle, E. C., and Armistead, G. C.: Unpublished Observations. (Cit. Wolff, H. G., and Hardy, J. D. On the Nature of Pain. Physiol Reviews 27:167, 1947. Quot. by Sinclair, et al).
4. Lorente de No, R. (Cit. by Kelly, M. Ref. No. 8.).
5. Gasser, H. S. Control of Excitation in the Nervous System, Bull. N. Y. Acad. Med. 13:324, 1937.
6. Lloyd, D. P. C.. Functional Organization of the Spinal Cord, Physiol Rev. 24:1, 1944.
7. Elliott, F. A. Aspects of "Fibrositis," Ann. Rheum. Dis 4:22, 1944.
8. Kelly, M. Fibrositis and Reality, Ann. Rheum. Dis. 4:46, 1944; Nature of Fibrositis, Ann. Rheum Dis 5:1, 1945, Interstitial Neuritis and the Neural Theory of Fibrositis, Ann. Rheum. Dis. 7:89, 1948

Protracted reflectory stimulations may not only initiate but also perpetuate over-excitation of internuncial pathways resulting in referred tenderness and in referred lesion at the zone of reference. "Residual effect" of traumas described by Gower may well come into this category.

(B) Stimulation of sensory nerve trunks (not of nerve endings!) is mainly, if not solely, capable of producing *referred* phenomena. Sinclair, et al.[1] are believed to have proved that referred phenomena produced by injection of hyper-tonic saline solution into interspinous ligaments are actually induced by irritation of the neighboring sensory nerve trunks and not by irritation of sensory nerve trunks run farther away from the respective interspinous ligaments of the lumbar spine did not produce referred pain because the lumbar sensory nerve trunks run farther away from the respective interspinous ligaments than the thoracal sensory nerve trunks.

These observations may explain why certain fibropathic lesions cause complex referred phenomena while others cause only local symptoms and/or signs, or remain silent altogether.

The same observations may also contribute to the understanding and management of arthalgia, the so frequently encountered subjective complaint of pain in joints which do not show any objective signs of disease.

Arthralgia may represent pain in a non-arthritic joint which became the area of reference to some extra-articular primary lesion. Hilton's law states that the same nerves which supply the muscles moving a joint furnish the sensory innervation of that joint. In fact, procainization of a "trigger area" frequently brings complete relief from pain in a neighboring joint.

Whether the concept of a separate system of deep pain sensation, segmentally not corresponding with epicritic sensations, aids to better comprehension of and to a more successful approach to the fibropathic syndromes remains to be seen.

II. Fibropathic Syndromes as Psychogenic Rheumatism

The concept that fibropathic syndromes represent a form of psychogenic rheumatism deserves more than a passing thought. Psychogenic "fibrositis" has been considered a somatic expression of such psychic states as tension, conversion hysteria, suppressed hostility, aggression, symbolization of frustration, submission.

Some authors have stated that almost all cases, if not every case of "fibrositis" is psychogenic; that clinical findings have no significance; and that *physical therapy may be harmful* because it may concentrate the patient's attention on his somatic symptoms.

The highlights to be considered with regard to these concepts — in order to avoid unsound application of sound psycho-somatic principles — are the following:

(1) Co-incidence of somatic symptoms and of emotional disturbances is no proof of the "psychogenic" origin of the somatic symptoms even in the absence of demonstrable organic pathology. Absence of pathological findings has been considered as evidence of pure psychogenic rheumatism, while presence of inadequate pathological findings was considered compatible with "super-imposed psychogenic" or "psychosomatic" rheumatism.

(2) Any fibropathic syndrome manifesting itself after emotional experiences has not necessarily been caused by them. "Post hoc" is not necessarily "propter hoc."

(3) Any subclinical, asymptomatic lesion can be rendered symptomatic by additional precipitating factors. As precipitating or aggravating factors,

however, not only inanimate environmental influences, may function (e. g., adverse climatic conditions, infection, traumas, toxins, etc.), but also psychic disturbances upsetting normal physiology of the central nervous system — without anticipating symbolistic, or hysterical mechanisms in their origin.[8] (See: "Facilitation from above" under "A.")

(4) There is sufficient evidence of the involvement of the endocrine and nervous systems in rheumatic disorders on one hand and of the influence of the endocrine and central nervous system on the personality on the other to assume that certain somatic and psychic symptoms in rheumatic patients may be concurrently caused by the same rheumatogenic agent. Frequently, it is difficult to differentiate between "psychogenic rheumatism" and "rheumatogenic psyche."

(5) Normal adjustmental mechanisms of rheumatic subjects frequently fail because of their being overburdened by the additional stress caused by the rheumatic process itself. (Pain, rejection, physical impairment, inadequacy, economic and social deprivation, deflated self-respect and inflated inferiority feeling, etc.) Symptom-consciousness, symptom-utilization, and symptom-exaggeration in all rheumatic subjects are more common than symptom-imagination. (Neufeld.[9])

(6) Psychodynamically speaking, sometimes "psychogenic rheumatism" may represent a "psychogenic" diagnosis to compensate for an unconscious feeling of inadequacy on the part of the diagnosing authority for not being able to demonstrate adequate objective pathological processes accountable for the symptoms, and to gratify our causalistic medical philosophy. ("The development of a special sense is often followed by atrophy of the common sense," said W. A. Lane.) (Gray.[10])

III. Increased Interstitial Hydrostatic Pressure

The concept of increased interstitial hydrostatic pressure in fibropathic syndromes presupposes that fluid accumulation within the inelastic fibrous tissues results in pain caused by mechanical distension, pressure and stretching.

This concept is significant for several reasons:

(1) Fatty tissue, a frequent site of fibropathic syndromes, is known to function also as storage of water:

(2) Electrolyte imbalance and variations in osmotic pressure which necessarily accompany the changing ion-concentration in the fluctuating interstitial fluid may result not only in mechanical but also in bio-chemical and/or bio-electrical stimulation of the sensory nerves of the affected connective tissues and be responsible for the notorious effects on rheumatic subjects of atmospheric changes. This patho-physiological phenomenon probably is the most frequent patho-genetic factor to be accounted for what one might call fibropathic diathesis in such a great number of persons.

(3) The well-known endocrinogen disturbances of certain fatty tissues, sometimes termed panniculitis, fat hyperplasia, and also related to adiposis dolorosa, may frequently be alleviated by systemic dehydration, and/or proper endocrine therapy. (Copeman.[11]) Decrease of local tension by injections, "needling," or deep massage, frequently improves or cures localized fibropathic syndromes. It is reasonable to assume that disturbances in the deli-

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[9] Neufeld, I.: Outline of Teleo-psychological Principles in Rehabilitation of the Physically Handicapped, Bull. Ind. Psychol. 4:17, 1951.

[10] Gray, C.: The Causes and Treatment of Sciatic Pain, Int. Abstr. Surg. 85:417 (Nov.) 1947.

[11] Copeman, W. S. C.: Fibro fatty Tissue and Its Relation to Certain Rheumatic Syndromes, Ann. Roy. Coll. Surg. 5:110, 1949; and Pugh, G. C. E.. Effects of Artificial Dehydration in Rheumatism, Lancet 2:384, 1945.

cate electrolyte-fluid homeostasis is mainly responsible for the notorious "tetralogy of fibropathic syndromes," namely pain, tenderness, post-inertial dyskinesia ("stiffness," or "jelling"), and easy muscular fatiguability.

IV. Traumatogenic and Post-Traumatic Fibropathic Syndromes

The role of trauma and mechanical maladjustment of the soft somatic tissues in the pathogenesis of fibropathic syndromes has unjustly been underestimated. On careful investigation, in many cases of localized fibropathic syndromes, traumatic and/or mechanical elements can be elicited as etiological as well as precipitating factors.

Acute traumas (e. g., acute herniations of fat lobules, sprains, and strains) cannot strictly be included among the fibropathic syndromes. Many chronic and recurrent, apparently "idiopathic" fibropathic syndromes, however, — although no major accident can be elicited in the patient's past history — belong to the group of the post-traumatic fibropathic syndromes. (Cf. "Residual effects of trauma" of Gower.)

Fibropathic reactions to trauma and to mechanical maladjustment may occur in many ways:

(1) *Prolonged immobilization* interferes with normal circulation of blood and lymph, with normal metabolism, and also with normal nerve conduction. Insufficient circulation in connective tissues, which are known to have a poor blood-vessel supply even under normal conditions, interferes with adequate absorption of extravasates, exudates, and tissue-debris and thus enhances biochemical fibropathic reactions.

(2) *Inadequate or unduly short immobilization* cause repeated irritation of the healing tissues, new extravasates, exudates, and prolonged swellings the organization of which is apt to result in fibropathic reaction because their duration was prolonged beyond possibility of complete absorption. Furthermore, repeated and increased pain sensations invoke the previously described reflex mechanisms of referred pain, tenderness and lesion, vasomotor disturbances, sympathetic dystrophies, etc., etc. (Cf. "Neural Reflex Mechanisms" under I.)

(3) *Injury to a sensory nerve* or to the tissues in its neighborhood is prone to develop into post-traumatic reflectory fibropathic syndromes and/or sympathetic reflex dystrophies despite proper treatment. (Cf. I.2.B.) In fact, fibropathic syndromes have often been considered a sort of "minor causalgia."

(4) *Soft tissue injuries,* frequently overlooked, unattended and even forgotten of, may leave predisposition to "fibropathic" episodes.

"Sprains" deserve special attention in this respect. Patho-mechanically sprains are momentary subluxations which because of the insufficiency of the attacking force, did not proceed to complete dislocation but were spontaneously and immediately reduced by themselves. According to the degree of the actually occurred momentary subluxation the joint capsule, the ligaments, and the peri-articular soft tissues were unduly stretched and/or partially torn with all the above discussed consequences.

(5) *Injury to asymptomatic osteo-arthritic joints* may bring about irritation of the joint by separation of minute osteo-phytic excrescences, and/or by overstretching the relatively inelastic capsule. Consequently, reflectory muscle spasm, referred pain, tenderness and actual lesions in the muscles moving or fixing that joint may follow. (See "Hilton's law" above.)

Thus an asymptomatic osteo-arthritis (or possibly even pure "osteophytosis" of Collins[12]) may be made symptomatic by trauma.[13]

(6) *Repeated micro-traumas, occupational and postural strains* play a similar role in the pathogenesis of fibropathic syndromes. Their significance, in a given case, however, seems to be more difficult to evaluate, especially from a legal point of view.

V. Faulty Metabolism in the Pathogenesis of Fibropathic Syndromes

(A) The significance of the electrolyte-fluid metabolism have briefly been outlined above. (III.)

(B) Creatine metabolism and deficiency in Vitamin E have been brought in connection with certain forms of fibropathic syndromes but denied by others.

Present knowledge of the possible pathogenic (experimental, clinical, and speculative) relationship between creatine metabolism, tocopherol administration, and fibropathic syndromes may be summarized thus:

1. The extent of "normal" creatinuria has not yet been determined. Creatinuria (up to 196 mg. per 24 hours) is being considered normal in females, especially during menstruation and pregnancy. In males, normally there is no creatinuria at all, or up to 100 mg. per day, in children up to 15 mg. per day.
2. Bedrest and immobilization of a limb in plaster cause increased excretion of creatine in the urine. Bedrest alone with or without vigorous massage but without rigid immobilization did not increase creatinuria. (Deitrick, et al.[14])
3. In systematic study on 38 "fibrositic" ambulatory patients, only 8 patients showed slightly increased creatinuria. (Sylvest and Hvid-Hansen.[15])
4. Creatinuria was reported to vary with the clinical course of fibrositis. (Brochner-Mortensen and Glemmesen,[16] and Wilson.[17])
5. "Blood tocopherol in fibrositic patients was 35 per cent lower than the average normal. After vitamin E medication the blood tocopherol level rose to an average of 58.5 per cent of the normal." (Ant.[18])
6. Administration of tocopherols seem to improve the clinical course of primary fibropathic syndromes. (Ant, Steinberg,[19] Wilson.)

(C) Blood Cholesterol determination in a number of patients suffering from fibropathic syndromes frequently revealed increased blood cholesterol levels. Although present material cannot yet be considered as conclusive, one fact seems to be significant: The increased blood cholesterol level was not always in direct proportion to the decreased basal metabolism rate. Final reports of this aspect will be reported at a later date. At any rate, thorough observation of certain aspects of cholesterol metabolism in fibropathic and rheumatic disorders may prove to be a worthwhile and fruitful undertaking.

The role of ten other factors in the pathogenesis of fibropathic syndromes cannot be elaborated upon in this condensed exposition.

On closer analysis, the different pathogenetic concepts by no means contradict each other (although frequently they might seem to do so). Some of them complement each other, in that in certain cases of clinical fibropathic syndromes one or the other mechanism seems to prevail, while in other cases two or more pathogenetic mechanisms may concurrently or consequently occur.

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12. Collins, D. H.: Pathology of Articular and Spinal Diseases, The Williams & Wilkins Co., Baltimore, 1950.

13. Hanlon, G. R., and Estes, W. L., Jr.: Osteo-arthritis Aggravated by Trauma, Am. J. Surg. 78:556, 1949.

14. Deitrick, J. E.; Whedon, G. D., and Schorr, E.: Effects of Immobilization Upon Various Metabolic and Physiologic Functions of Normal Men, Am. J. Med. 4:3, 1948.

15. Sylvest, O., and Hvid-Hansen, N.: Investigation of the Creatine Excretion in the Urine, Ann. Rheum. Dis. 9:241, 1950.

16. Brochner-Mortensen, K., and Clemmesen, S.: Creatinuria in Patients with Palpable Muscle Affection (Myosis), Acta Med. Scand. 106:540, 1941.

17. Wilson, M. J.: Personal Communication.

18. Ant, M., and Mamelock, A. E.: Vitamin E in the Treatment of Fibrositis with Complicating Osteoarthritis, Med. Times 76:162, 1948.

19. Steinberg, C. L.: Tocopherols in Treatment of Primary Fibrositis, J. Bone & Joint Surg. 24:411, 1942.

In conclusion, it should be remembered that when our clinical experiences with fibropathic syndromes do not concur with our theoretical concepts, one should recall Michael Kelly's warning: "If our theories do not accord with observed facts, it were wiser to modify our theories rather than explain away the facts."

Summary

Essentially, this presentation is a summary of certain pathogenic concepts (mainly the neuro-anatomical, neuro-physiological, psycho-somatic, physico-chemical, traumatological, and metabolic aspects) of "fibrositis" and their objective evaluation in the light of available clinical and experimental research. The term "fibropathic syndromes" is considered to be more appropriate as a collective term for all the clinical conditions for which "fibrositis" has uncritically been used. The four chief symptoms ("tetralogy of fibropathic syndromes"), namely: pain, tenderness, post-inertial dyskinesia (usually but improperly called "jelling" or "stiffness"), and easy muscular fatiguability, may more satisfactorily be approached if one is familiar with the main principles of the patho-mechanism of these mainly functional syndromes. Certain peculiar features, such as non-arthritic joint pain (arthralgia), non-segmental reflectory phenomena (often labelled as "hysterical"), weather-sensitivity, responses to physical and other therapeutic procedures, psychogenic rheumatism, psychogenic diagnosis, rheumatogenic psyche, stress-conditioned rheumatic symptoms, post-traumatic and traumatogenic fibropathic conditions are briefly discussed on the basis of presently available scientific data.

A strong plea for further research along the mentioned lines, and against rejection of patient's justified but not fully understood complaints, and against unsound application of sound psychosomatic principles have been stressed.

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MEDICAL NEWS

Members are invited to send to this office items of news of general interest, for example, those relating to society activities, new hospitals, education, etc. Programs should be received at least three weeks before the date of meeting.

Correction

In the April, 1952, issue of the ARCHIVES, announcement was made concerning the Congress members who had attended the Latin-American Congress of Physical Medicine, Panama City, February 25.

The name of Dr. **John C. Hubbard** was inadvertently omitted. Dr. Hubbard presented a paper entitled "Reviewing the Galvanic Current."

Our apologies to Dr. Hubbard.

Symposium on Poliomyelitis

A symposium on Poliomyelitis was presented at the Miami Valley Hospital, Dayton, Ohio, May 27-28, 1952, under the direction of Herman J. Bearzy, Head, Department of Physical Medicine and Rehabilitation.

The morning session consisted of the following topics: "Etiology and Epidemiology of Poliomyelitis," by Melvin Oosting, M.D.; "The Neurologic and Pathologic Physiology of Poliomyelitis," by N. R. Hollister, M.D.; "The Clinical Aspects and Treatment of Acute Poliomyelitis and Bulbar Poliomyelitis," by Mason Jones and W. B. Taggar; "The Role of the Otolaryngologist in Bulbar Poliomyelitis," by J. T. Bickmore; "Physical Medicine in the Treatment of Poliomyelitis," by Herman J. Bearzy, and "The Role of the Orthopaedic Surgeon in the Treatment of Poliomyelitis," by H. F. Hilty.

The afternoon session was devoted to clinical demonstrations on "Nursing Care in Poliomyelitis"; "Use of the Respirator"; "Muscle Testing and Muscle Reeducation Exercises"; "Occupational Therapy Activities"; "Splinting and Bracing Procedures," and finally, open discussion.

Brochure for Handicapped Workers

The Easter Seal Society has prepared a brochure on "Careers in Service to the Handicapped" to help young people secure information about positions for the handicapped in the field of rehabilitation. The National Society for Crippled Children and Adults will distribute gratis more than 23,000 copies to public and parochial school systems. Copies will also be donated to every college and university throughout the United States. For those not able to obtain copies gratis, the charge will be 50 cents. These may be secured by writing either to the National Society for Crippled Children and Adults or the National Foundation for Infantile Paralysis.

Pennsylvania Academy of Physical Medicine and Rehabilitation

At the April meeting of the Pennsylvania Academy of Physical Medicine and Rehabilitation, Dr. Temple Fay presented an illustrated lecture on "Status of Rehabilitation in Denmark and the Scandinavian Countries," accompanied by colored motion pictures.

At the May meeting, Dr. J. F. Rubacky presented the topic "Evaluation of Orthopedic Disabilities Due to Trauma," followed by a question and answer period. Officers for the ensuing year were elected at the business meeting.

Conference on Exceptional Children

The Woods Schools, Langhorne, Pa., sponsored a conference on "Helping Parents and Teachers Understand Exceptional Children" on May 20. The purpose of the all-day meeting was "to contribute to greater understanding of the child, who, because of a physical handicap, a mental defect or emotional problem, does not respond to the regimen of regular school work." The solution to the problem must be met by special classes in public schools, by special schools themselves, and by increased understanding at home.

The following topics were presented: "The Psychology of the Exceptional Child"; "Emotional Quandaries of Exceptional Children"; "The Child from the Editor's Chair"; "Growth of Social Responsibility for the Exceptional Child" and "How to Build Understanding of the Exceptional Child."

Any inquiries concerning the conference should be directed to Dr. A. Ralph Carli, The Woods Schools, Langhorne, Pa.

Schedule for Graduate Courses, 1952-53

The schedule for short-term graduate courses for physicians, physical therapists, occupational therapists, nurses and counsellors given at the Institute for Physical Medicine and Rehabilitation, New York, N. Y., has been announced. It follows:

Physicians — July 14-25; Sept. 22-Oct. 17, 1952.

Physical Therapists — Oct. 27-Nov. 21, 1952; Jan. 5-30, 1953.

Occupational Therapists — Oct. 6-24, 1952; Mar. 3-Apr. 10, 1953.

(*Medical News Continued on Page 372*)

ARCHIVES of PHYSICAL MEDICINE

OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL MEDICINE

∴ EDITORIAL ∴

ANNUAL SESSION — AUGUST 25-29, 1952

The thirtieth annual session of the American Congress of Physical Medicine will be held in New York City, August 25-29, 1952, at the Hotel Roosevelt. The selection of the last week in August for this year's meeting will please many members who in the past have found the Labor Day week, which has been the one usually chosen, had conflicted with many other plans and activities. The choice of New York City is also a wise one since it will permit the greatest number of physiatrists and persons interested in Physical Medicine to attend.

The Scientific sessions will be confined to one session in the morning and one session in the afternoon. The number of papers submitted far exceeded the time permitted for the reading of all the papers, necessitating the listing of a number of papers to be read by title only. All the papers for this meeting, both those to be read at the sessions and those to be read by title only, are exceptional — many contain the latest information on the clinical application of physical measures; many bring out the latest developments and utilization of the various facets of rehabilitation, and many describe the newest clinical and basic research investigations that have been carried out during the past year. Practically every subject in the field of Physical Medicine and Rehabilitation will be presented.

The Scientific exhibits this year should arouse unusual interest. The number of applications was the largest for any meeting. The exhibits prepared by the many clinics and hospitals will show much original material; also the practical use of many features of Physical Medicine and Rehabilitation. The opportunity of studying these exhibits and asking questions or discussing definite problems with the exhibitors, is actually a post-graduate course in itself.

The Seminar arranged by the Committee on Education of the American Congress of Physical Medicine will consist of sixteen instruction courses. As in the past, the lectures will be divided into two groups — the one pertaining to basic and research problems should interest physiatrists particularly; the other group includes the various clinical subjects which should appeal to all physicians and other personnel in Physical Medicine and Rehabilitation. The committee has again secured outstanding authorities for these lectures whose selection is based not only on their knowledge of the subject but also on their ability to present a complete and clear review of the material. The Seminar courses have always been well attended so that an early application is suggested.

In the Technical exhibits, the latest apparatus, supplies and other material will be demonstrated. This section affords the visitors a chance to see and evaluate the various types of equipment used today in the departments of Physical Medicine and private offices and to ask the exhibitors specific questions as to their operation and function. Every worthwhile manufacturer and distributor of physical medicine material will be present.

The banquet this year will be addressed by a man internationally famous in many walks of life. His support and interest in Physical Medicine has done much to aid this specialty. His speeches are known for their sagacity and stimulation, and are long remembered. Other new features for this evening will make it a gala event.

Many visitors find that a certain amount of play aids work. Certainly New York City offers a greater variety and volume for "relaxation" than most cities. The attractions at the theaters, sports events, museums, and musical recitals of varied types, are sufficient for all tastes. The famous dining places are in themselves a real diversion.

This thirtieth annual meeting should be one of the best. The greater the interest and enthusiasm by the greatest number, makes for the best organization.

Medical News

(Continued from Page 370)

Personals

Dr. **John H. Aldes**, Los Angeles, will present a paper entitled "The Use of Ultrasonic Therapy in the Treatment of Hypertrophic Arthritis With and Without Radiculitis — Geriatric Group" at the International Congress of Physical Medicine, London, July 14-19. Dr. Aldes is also attending the American and British Orthopedic Association meeting in London and will make a tour of the rehabilitation centers in the Scandinavian countries before returning to the U. S.

Dr. **Louis B. Newman** addressed the Regional Chapter of the American Acadamy of General Practice in Chicago on May 22, 1952. Dr. Newman's illustration lecture was on "The Scope of Physical Medicine and Rehabilitation."

Dr. **Edward E. Gordon** has been named Director of Medical Services at the Institute for the Crippled and Disabled, New York, N. Y. He has also been named Associate Professor of Rehabilitation Medicine at the College of Physicians and Surgeons, Columbia University.

Dr. **Waldemar Bianchi**, has been appointed professor of physical medicine, Faculdade de Ciencias Medicas, University of Federal District, Rio de Janeiro, Brazil.

Dr. **S. Malvern Dorinson** of San Francisco, California, recently presented the topic "Physical Medicine in General Practice" at the San Francisco Medical Society.

Conference on Aging

Housing the Aging is the topic for the University of Michigan Fifth Annual Conference on Aging to be held in Ann Arbor, Michigan, July 24-26, 1952.

The three-day conference will consider the housing needs of healthy, chronically ill, confused and disabled older people living in urban and rural areas. Among the topics to be discussed are types of housing and living arrangements; architectural designs and costs; hygiene and safety standards; social and economic aspects of housing; and auxiliary services. The conference is designed to serve as a forum for interchanging information and for getting action on the difficult problem of financing housing for the aging.

The conference is under the co-sponsorship of the Institute for Human Adjustment, Schools of Architecture, Business Administration, Social Work, Public Health, and the Medical School, Extension Service and Summer Session of the University of Michigan; the Michigan State Medical Society; the Committee on Aging and Geriatrics of the Federal Security Agency, Washington, D. C., and the Housing and Home Finance Agency, Washington, D. C.

Conference registration materials may be obtained by writing to Dr. Wilma Donahue, Institute for Human Adjustment, Room 1510 Rackham Building, Ann Arbor, Michigan.

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BOOK REVIEWS

The reviews here published have been prepared by competent authorities and do not represent the opinions of the American Congress of Physical Medicine.

A DOCTOR'S PILGRIMAGE. By *Edmund A. Brasset,* M.D. Cloth. Price, $3.50. Pp 256. J. B. Lippincott Company, 227-231 S. Sixth St., Philadelphia 5, 1951.

The protagonist of this story tells of his experiences from the time he finishes his internship in the hospital at Halifax to the day, years later, when he finally decides to make no further efforts to become a brain surgeon. During this interval he practices in several towns in Nova Scotia, serves as assistant physician in a mental hospital, takes postgraduate courses, and begins a residency in neurosurgery. In each situation there recur the conflicts resulting from a distressing innocence in money matters, the false attitudes that pass for scientific among some medical school faculties, the generous impulse to devote every ounce of his strength to the unending succession of patients who need him, and the need of a normal man for wife, home, and family.

There is not a dull or affected page in this book; it is utterly sincere and has the fascination of genuine though restrained realism. One closes it with the feeling that every medical student, and many physicians, ought to read it.

VITAMINS AND HORMONES. ADVANCES IN RESEARCH AND APPLICATIONS. Edited by *Robert S. Harris,* Professor Biochemistry of Nutrition, Massachusetts Institute of Technology, Cambridge, Mass., and *Kenneth V. Thimann,* Professor of Plant Physiology, Harvard University, Cambridge, Mass. Vol. IX. Cloth. Price, $8.00. Pp. 395, with illustrations. Academic Press, Inc., 125 East 23rd Street, New York 10, 1951.

The reviews on vitamins in this volume reflect the view, now increasingly accepted, that vitamins act basically as coenzymes. Thus, the functions of vitamin B_{12} and of folic acid are considered in terms of purine and pyrimidine biosynthesis and metabolism and of the participation of "labile methyl groups" and formate; the antimetabolites of nucleic acid metabolism and the enzymatic reactions of biotin are extensively considered.

The sections on steroids deal with the interrelations of vitamin deficiencies and the adrenal cortex, the enzymatic associations of estrogens, the synthesis of radioactively labeled steroids of clinical interest and an authoritative discussion of the activities of cortisone and ACTH.

Each of the contributors is an expert in his special field; their papers are well organized, appropriately critical and admirably concerned with causes and mechanisms. It is unavoidably unfortunate the pace of modern science renders such a book out of date even before it is published. The clinician interested in the fundamental aspects of pernicious anemia, cobalt deficiency and the collagen diseases will gain much from perusal of relevant chapters.

THE BATTLE FOR MENTAL HEALTH. By *James Clark Moloney,* M.D. Cloth. Price, $3.50. Pp. 105. Philosophical Library, Inc., 15 East 40th St., New York 16, 1952.

The author is a member of a group that founded the Cornelian Corner in Detroit in 1942. Their objective might be summarized in that they are strong supporters of T. L. C. (Tender Loving Care) of mother-child relationship. They advocate natural childbirth, "rooming" procedures in maternity hospitals, breast feeding, permissive child rearing, etc. This short book sets forth the author's concept of mental health and illness in this and other civilizations and a few suggestions for its improvement. Most of the ideas are interesting and stimulating; however, his explanation of the conflict in a child who is bottle fed leaves this reviewer a bit unimpressed. The statement is made that the "head end of the baby, where he was hungry, he had no warm, interpersonal relationship with his mother. At the other end, however, where he defecated and urinated at will into a diaper, the baby did have opportunity for a warm relationship with his mother" — because "the anal end was more considerately treated."

STANDARD NOMENCLATURE OF DISEASES AND OPERATIONS. Fourth Edition. By *Richard J. Plunkett,* M.D., Editor, and *Adaline C. Hayden,* R.R.L., Associate Editor. Published for the American Medical Association. Cloth. Price, $8.00. Pp. 1034, with four illustrations. The Blakiston Company, 1012 Walnut St., Philadelphia 5, 1952.

This new edition has been completely revised and brought up to date since the last edition in 1942. "Code numbers for acute and chronic conditions are made consistent, new heart diagnoses are included, diseases of hemic and lymphatic systems are revised to conform to accepted terminology, the dental and tuberculosis sections are enlarged, and the section on operations includes new operative procedures used in skin grafts and cardiac surgery. Also, the supplementary terms are placed in one section and the disease and operations indexes are placed consecutively in the book. In addition to these revisions, an International Statistical Classification of Diseases, Injuries and Causes of Death is included. These code numbers are cross referenced to the 'Standard' code numbers."

PSYCHOLOGICAL DYNAMICS OF HEALTH EDUCATION.

Proceedings of Eastern States Health Education Conference, April 13-14, 1950. (Under auspices of New York Academy of Medicine.) Cloth. Price, $2.50. Pp. 134. Columbia University Press, 2960 Broadway, New York 27; Oxford University Press, Amen House, Warwick Sq., London, E. C. 4, 1951.

As Simmons remarks on page 56 of this excellent book, the knowledge and control of man, not matter, is our present most urgent scientific problem. This book consists of thirteen sections by various authors, and their consistently temperate, penetrating manner inspires the hope that this problem may some day be solved. They are all concerned with one aspect of this problem, namely, the motives to which one can appeal when going to the public with any given program of health education.

Several chapters discuss the peculiar psychological dynamics of special groups such as the adolescents; others take up group tensions, such as those involving minority groups. There is a chapter on the dynamics of mass media, publicity and advertising, and several chapters take up the motivations that can be used in particular problems such as venereal disease education. One question, for instance, is the extent to which the educator can appeal to fear by "scaring the public"; another is how to overcome the strong feeling of personal immunity in some people. It appears that psychologists have receded somewhat from the uncompromising ideal of "accentuating the positive and eliminating the negative." On page 129 there is a guarded hint that people may need to be "prepared to be ill," and on page 105 is the reluctant admission that all of us face eventual death and must respect the fact. These things, too, must be remembered in connection with health education.

This book can be read with profit by practicing physicians, by medical students, by those teaching in medical schools or teaching physiology and hygiene in any other kind of school, by every one active in rehabilitation, and by those concerned with the public relations of medical institutions such as hospitals.

SOCIAL MEDICINE IN WESTERN EUROPE:

Report of a World Health Organization Traveling Fellowship, Summer, 1950. By *E. Richard Weinerman*, M.D., M.P.H., Medical Director, Permanente Health Plan, Oakland, California. Visiting Associate Professor of Medical Economics, School of Public Health, University of California, Berkeley. Paper. Price, $2.00. Pp. 82. School of Public Health, University of California, Berkeley, 1951.

This report covers a three months survey of social medical programs in England, Scotland, Belgium, Holland, Denmark, Sweden, Switzerland and France.

The term "Social Medicine" is defined as "an extension of the older confines of public health into the broadest consideration of social, emotional and administrative aspects of health." The report is divided into three sections — 1, Teaching and Research; 2, Public Health Organization and 3, Medical Care Organization. Most of the information is factual, however on occasion the author's impressions may have been influenced by his personal opinion. He has considerable respect for the conditions he found in Great Britain. He summarizes the medical care there as follows — "the National Health Service was found to be a tremendous step forward in the financing of a comprehensive program for an entire nation. Its base of tax support rather than insurance premiums gives it a stability and completeness of coverage unequaled in Western Europe." And the implication of the following quotation might appear to be biased by some — "Where economic conditions are favorable, and where governmental policy is progressive, health conditions and controls are seen to be more satisfactory. Where the economic situation is difficult and where conservatives are in control of national policy, there are decidedly poorer health conditions."

In the author's visit to the Copenhagen Mother's Welfare Center, among the things he observed was the "rehabilitation of prostitutes." This should be novel but to this reviewer it would seem that the word rehabilitation is being prostituted.

PHYSICAL MEDICINE ABSTRACTS

Evaluation and Physical Medicine Treatment of Arteriosclerotic Peripheral Vascular Disease. Bror S. Troedsson.

J. Nat. M. A. 43:31 (Jan.) 1951.

Arteriosclerosis is the number one disease of the present age and will become more so as the percentage of aged people increases. The disease may affect the arteries in all or in localized parts of the body. The heart, the kidneys, the brain and the lower extremities are the structures most frequently giving symptoms. The treatment of peripheral arteriosclerotic vascular disease must have as its object a permanent increase of circulation to the extremity. To achieve this the problem must be attacked from two angles. The primary object is to try to increase the carrying capacity of the affected deeper vessels. The second object is to try to develop the carrying capacity of the collateral vessels, the arterioles and the capillaries. In physical medicine we have a number of agents that can be applied for these specific purposes and to specific areas without causing any undesirable side actions. Although there are hundreds of measures available, mention will be made only of the ones the author uses most extensively. If access to only one measure was possible, Troedsson would pick massage as the most important. Massage dilates capillaries and empties veins and thus permits secondarily easier inflow of arterial blood. In trained and skilful hands massage can be directed to the affected arteries and used to stretch fibrous tissue in the vessels and possibly also break up early calcifications. Some of the effects of massage are better obtained by the use of mechanical apparatus. The Sanders' oscillating bed has a see-saw motion and in its upward tilt empties the venous bed of the lower extremities. In the downward tilt it promotes the influx of arterial blood. This bed has the advantage of being able to do it continuously for unlimited time. In the use of the Sanders' bed, as well as the Buerger's exercises, we use the venous filling time to determine the time for dependency of the extremities and blanching time for period of elevation. Besides the Sanders' bed, the author has found the suction pressure boot, as developed by Herrman, of great value if properly understood and used. This apparatus, called the Pavaex, is used for its pumping action and the exercising action upon the capillary bed, an important phase of the treatment. Troedsson does not believe and has not found any clinical evidence that it affects the deeper arteries to any extent, though it may. The Pavaex apparatus must be used with great attention to detail and must be adjusted for each individual each time a treatment is given, so that a distinct flushing and blanching is produced with each cycle. This involves putting the extremities at the proper height, adjusting the pressures and the cycle, and adjusting the cuff pressure to where it barely prevents escape of air during the positive pressure phase. Unless this attention to details is carried out the results expected cannot be obtained and even harm may be done. It is the author's conviction that the Pavaex should be used only in the hands of people who are willing and capable of giving it the detailed attention it needs. It is not an apparatus to be mechanically applied, as has often been the case and which has detracted from its usefulness. Practically every application of the Pavaex apparatus should be followed by "vascular massage" to the deeper vessels. The same applies to the whirlpool. This apparatus with its whirling, aerated, temperature adjusted water is very useful to create a hyperemia and to give a gentle massage at the same time. However, again it must be used only after a thorough evaluation of the circulatory capacity and generally only in the milder cases, followed by massage. Physical medicine has many valuable agents, that can be specifically applied to specific areas in the treatment of arteriosclerotic peripheral vascular disease. Properly applied they are of more value than any medicinal agents in the treatment of uncomplicated peripheral arteriosclerotic vascular disease.

Intractable Pain in the Neck and Upper Extremities with Particular Reference to Protrusion of Cervical Disks. J. Grafton Love.

North Carolina M. J. 12:274 (July) 1951.

Pain in the neck and upper extremities is a common complaint. Before satisfactory treatment can be carried out, the attending physician must determine the etiologic factor and the pathologic process. It is not uncommon for a person to have soreness in the neck following exposure to drafts. This condition probably is the result of a myositis, and usually will respond to the exhibition of salicylates and local heat with or without gentle massage. The conservative treatment of the scalenus anticus syndrome, whether cervical ribs are present or not, is physical therapy in the form of local heat and massage, and exercises to strengthen the muscles about the shoulder girdle and so prevent sagging of the upper part of the chest. The scalene syndrome is more commonly seen in women than in men, and those women with large pendulous breasts should be instructed to use an adequate support. Brachial neuritis is a diagnosis that formerly was rather commonly made in cases of pain involving the upper extremity or the shoulder girdle. Brachial neuralgia is associated with pain in the distribution of one or more nerves of the brachial plexus. If the etiologic factor cannot be determined when the patient presents this complaint, such conservative measures as resting the extremity, avoiding motions which aggravate the pain, the administration of salicylates, and the use of local heat and possibly gentle massage, should be outlined. The patient should be kept under observation and examined periodically for abnormal changes such as the loss of a tendon reflex, the loss or diminution of sensation, or the weakening of any muscle or group of muscles. The conservative treatment of protruded intervertebral disk or of symptoms and signs of involvement of one or more nerve roots in the cervical region consists of the application of cervical traction. This may be done in many ways. Traction may be administered by means of a halter, under the direction of a physician or physical therapist. A homemade halter may be provided and the patient instructed in using it in his own bed. Traction can be applied at night when the patient retires, and he can sleep in the apparatus; or, if the pain is severe, it may be necessary to apply continuous traction day and night. Some patients benefit from the application of heat to the muscles of the neck, particularly those posteriorly, and some feel better after gentle massage of these muscles. Four case reports of protrusion of a cervical intervertebral disk are given in order to indicate the symptoms, signs, methods of investigation, and a type of treatment which has brought about excellent results.

The Place of Occupational Therapy in Physical Medicine. Phyllis Lyttleton.

Brit. J. Phys. Med. 14:107 (May) 1951.

This is not a discussion of the contributions of all the members of the physical medicine team, but rather a consideration of occupational therapy with as fair an appraisal of its "cans" and "can'ts" as has been found during some years of practice in the physical field, both as physical therapist and occupational therapist. Briefly, occupational therapy assists that part of the healing process which enables a patient to coordinate and correlate all his returning powers towards the normal. For occupational therapy to be of value it must be started early. It must begin when the patient is first able to put forth constructive effort, so that this effort may be directed immediately into the normal channel of creative work, thus preventing the formation of that barrier between physical recovery and total coordination which occurs when recovery is not immediately harnessed to function. With regard to the more usual interpretation of coordination, that on the purely physical plane, occupational therapy provides the ideal treatment, for coordination can only be achieved by use, and the normal activity of the part is obviously its best use. One advantage of occupational therapy over gymnastics lies in the time factor. Fatigue will limit the practice period in either department, but in occupational therapy the interest and concentration required usually postpone the onset of fatigue most markedly. For endurance there is little doubt that occupational therapy is of value. However, endurance of itself has no virtue; it is the capacity to do a certain job continuously without tiring that is the goal, and only by doing the job, or one very like it, can the patient's endurance be so developed that he may return to work having regained his confidence in his ability to do his job.

Recent Developments in Pool Therapy. H. L. Milles.

Brit. J. Phys. Med. 14:249 (Nov.) 1951.

The main purpose of this article is to evaluate one of the most useful qualities of brine, namely, its buoyance. The methods of using this unique property to the best advantage are discussed, though its possibilities are still being explored. It is evident that many advantages arise from the buoyancy of the brine; for instance, the severely crippled or paralyzed patient is fully supported and can be moved into position with ease, thus saving much time and work for both the physical therapist and patient. Furthermore, the complete support of the body, resulting in relaxation, facilitates instruction in both assistance and resistance exercises, and widens the scope of muscle reeducation. All these various possibilities are still being developed, and recently a bay has been built in the Brine Swimming Pool where the physical therapist can handle the patients without entering the brine, and has full control of their movements while instructing them in suitable exercises When his progress is satisfactory, the patient can continue in the general swimming pool. Bedridden patients can make their preliminary attempts at walking by the support of the brine, if necessary between parallel bars, their progress being so arranged and graded that they can very gradually support more of the body-weight as they move into shallower brine. For shoulder-joint movements the patient is fixed to a seat which can be altered in height. Wall-bars add further to converting the pool into a water gymnasium.

Further progress of the patient is supervised in the "dry" gymnasium, and particular emphasis is laid on simple home exercises. Furthermore, a list of home tips for the handicapped is available, and it is hoped that at an early date a series of demonstrations of various "aids" will be arranged.

Contents—July, 1952

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ORIGINAL ARTICLES

Influence of the Pituitary-Adrenal Axis on the Hemogram of Febrile White Rats. Willis L. Hubler, M.D.; George M. Higgins, Ph.D., and J. F. Herrick, Ph.D. 391

Effect of Massage on Muscle Temperature and Radiosodium Clearance. Alfred Ebel, M.D., and Lawrence H. Wisham, M.D. 399

Incidence of Pain in Idiopathic Scoliosis. Leonard F. Bender, M.D.; Rex O. McMorris, M.D.; Earl C. Elkins, M.D., and Joseph M. Janes, M.D. 406

The Nature and Treatment of Fibrositis. Alfred J. Martin, D. Phys. Med. 409

Background for an Understanding of Spine and Trunk Function. Daniel P. Quiring, Ph.D. 414

Editorial 425

Medical News 428

Book Reviews 430

Physical Medicine Abstracts 431

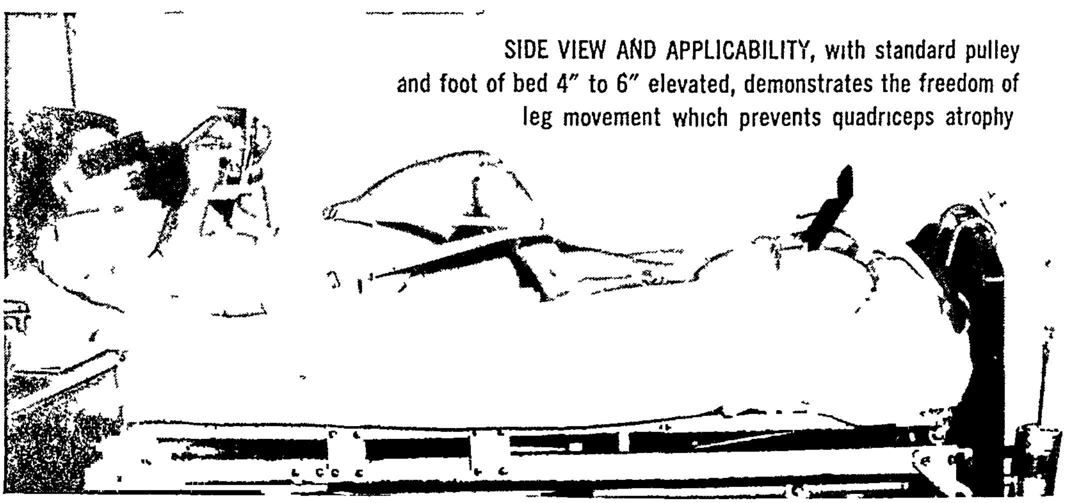
Preliminary Program, 30th Annual Session, American Congress of Physical Medicine 432

EDITOR OF THE MONTH

EARL C. ELKINS, M.D.

Rochester, Minn.

Printed in U.S.A.



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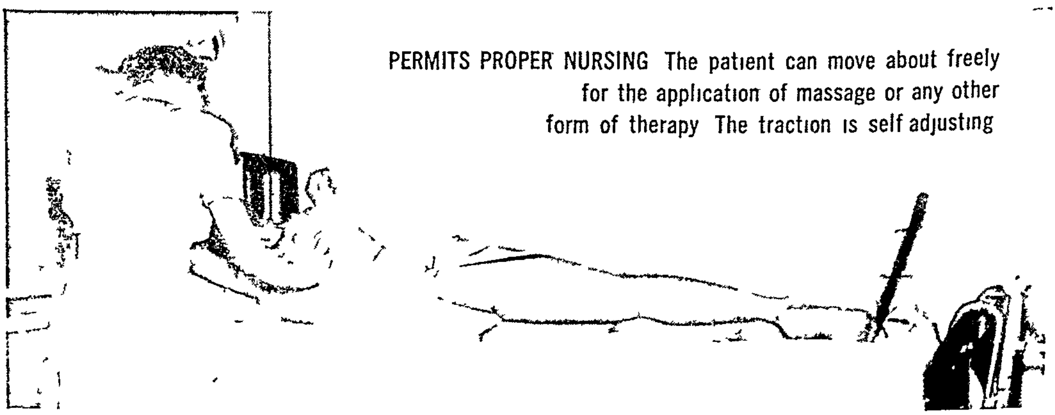

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INFLUENCE OF THE PITUITARY-ADRENAL AXIS ON THE HEMOGRAM OF FEBRILE WHITE RATS *

WILLIS L. HUBLER, M.D.
GEORGE M. HIGGINS, Ph.D.
and
J. F. HERRICK, Ph.D.

(With the Technical Assistance of Mary J. Woods, and Glen Christensen)

ROCHESTER, MINN.

It has been known for many years that fever produces certain characteristic changes in the leukocytic pattern of the peripheral blood of man and of experimental animals. In 1935 Hargraves, Doan and Kester[1] studied these changes in rabbits in which they had induced temperatures up to 109.8 degrees F. using the Kettering hypertherm or the radiotherm. They observed early leukopenia, followed five to seven hours later by leukocytosis. This was mainly a polymorphonuclear response consisting largely of young forms, and was interpreted as a delivery of immature cells from the bone marrow into the circulation.

A review of the recent literature has emphasized the similarity of such leukocytic changes following hyperpyrexia to those which follow a variety of alarming stimuli or exogenous ACTH or 11-17 oxysteroids.[2-5] These reactions have been accepted as circumstantial evidence that the characteristic hematopoietic response to hyperpyrexia may be mediated through the anterior pituitary gland and the adrenal cortex. It was the purpose of this study to subject this concept to direct investigation.

Experimental Methods

Since it was necessary to restrain all animals in a suitable cage, in order to expose them satisfactorily to the microwaves, it was essential that the changes in the blood categories induced by cage restraint, per se, be recorded. Freely flowing blood samples were obtained by cutting either the left or the right lateral tail vein, after the organ had been immersed in warm water. Using the United States Bureau of Standards pipets, the total leukocyte counts and the total eosinophilic leukocyte counts per cubic millimeter of blood were determined. The total eosinophilic leukocyte distributions were computed according to a modification of the Dunger technique,[6] using the Fuchs-Rosenthal counting chambers. By means of suitably stained smears, the absolute numbers of neutrophilic polymorphonuclear leukocytes and the

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* Abridgment of thesis submitted by Dr. Hubler to the Faculty of the Graduate School of the University of Minnesota in partial fulfillment of the requirements for the degree of Master of Science in Medicine.

* Read at the Meeting of the American Congress of Physical Medicine, Denver, Colo., Sept. 8, 1951.

* From the Division of Experimental Medicine, Mayo Foundation, University of Minnesota, Rochester, Minnesota.

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absolute numbers of mononuclear leukocytes per cubic millimeter of blood were determined.

Animals which were selected for heating experiments were always trained for a period of days by confining them in plastic cages (fig. 1) in which they would later be subjected to the microwaves. This training, wherein animals were restrained for one hour daily, with rectal thermistors in place, continued for a week or ten days. Such training always minimized those blood changes which fright or emotional disturbances invariably incite.

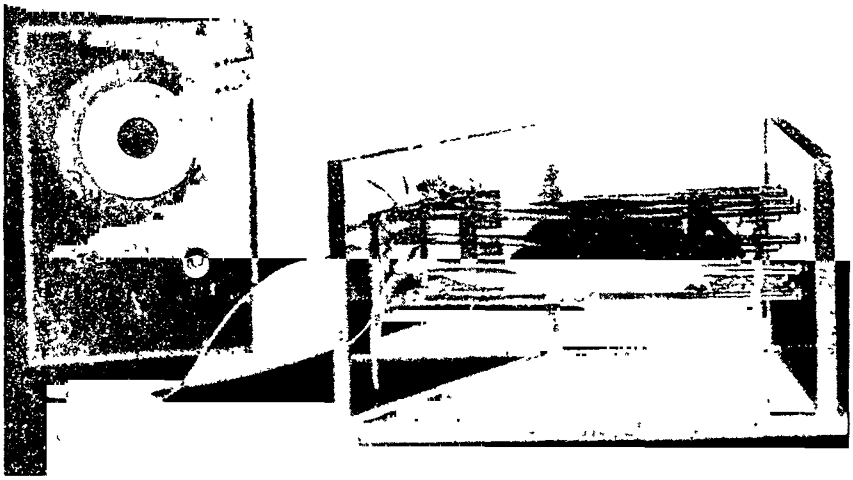

Fig. 1. — The plastic cage, the animal in place and the temperature recording device.

At 8:00 a. m. on the day following a satisfactory training period, samples of blood were obtained from the tail vein, and control data on the blood categories were established. Each animal was placed in its restraining cage, the rectal thermistor was inserted, and the animal was placed within the field of the Raytheon microwave machine (fig. 2) for one hour. The output of this machine was so regulated as to maintain a rectal temperature ranging from 41.0 degrees to 41.5 degrees C. Heating and cooling curves were established (fig. 3).

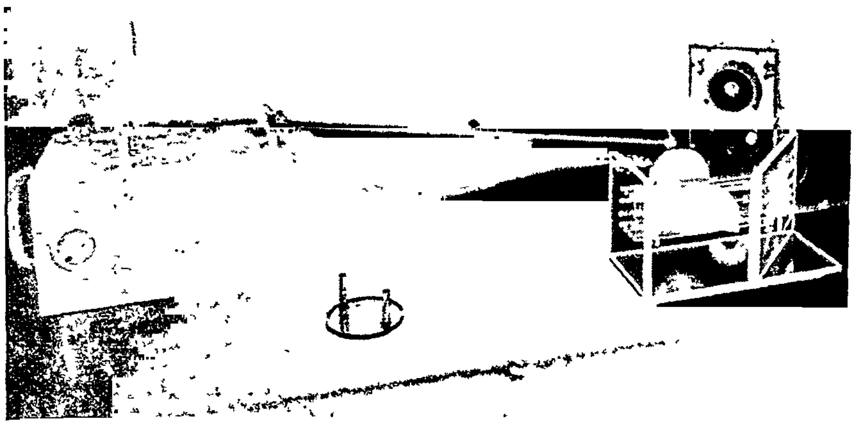

Fig. 2. — The Raytheon microwave apparatus, and the manner in which heat was applied.

Blood samples were obtained immediately after heating, and at one, two, four, six, ten, twenty-four and forty-eight hours thereafter. Blood samples were also obtained at corresponding intervals after the animal had been caged for one hour. Normal intact animals, adrenalectomized animals, hypophysectomized animals, hypophysectomized-adrenalectomized animals and adrenal-demedullated animals with and without the exposure to microwaves were studied.

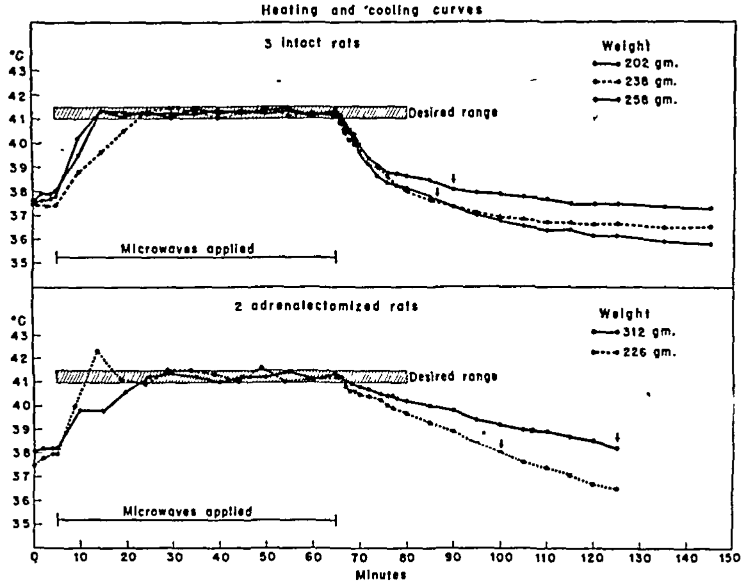

Fig. 3. — Heating and cooling curves of 3 intact rats and of 2 adrenalectomized rats.

Results

I. *The Eosinophilic Leukocyte Response.* — Data assembled on the changes in the distribution of the eosinophilic leukocytes of animals subjected to caging alone, and to caging together with the influence of microwaves, are portrayed in figures 4, 5 and 6. Simple confinement within the restraining cage

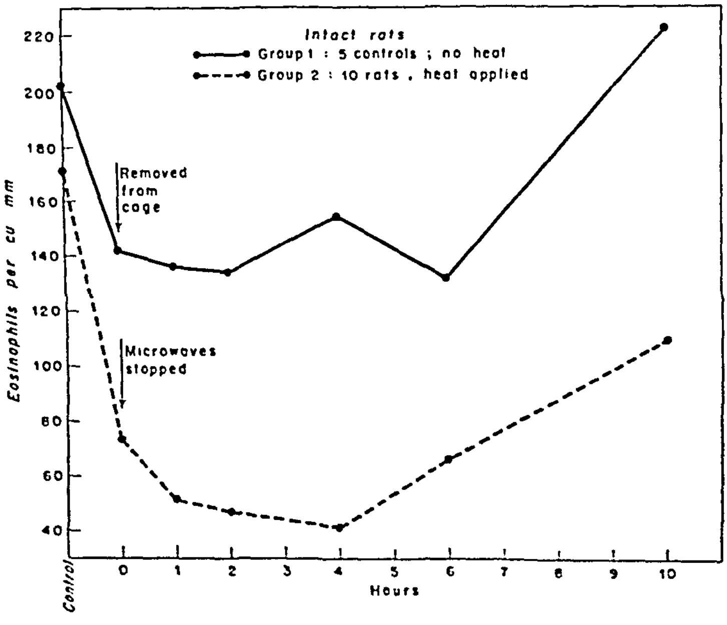

Fig. 4. — Changes in the eosinophil distributions of rats which were caged for one hour, and of rats which were caged and heated for one hour.

for one hour induced considerable eosinopenia, which persisted for at least six hours. Normal levels had been restored when the blood was sampled ten hours after the rats had been removed from their cages (fig. 4). But when heat was applied to these same animals confined in the same cages these

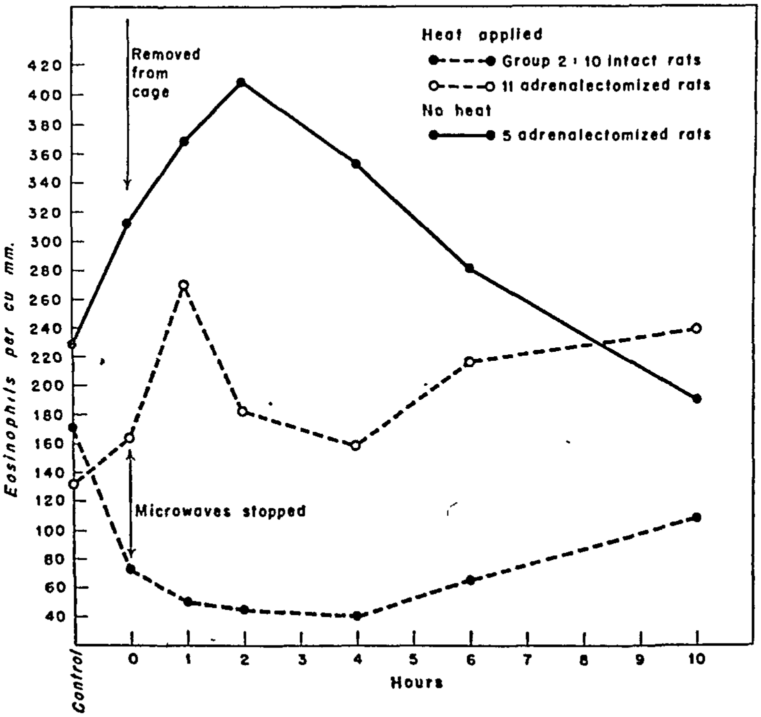

Fig. 5. — Changes in the eosinophil distributions of intact and adrenalectomized heated rats, and of adrenalectomized rats which were caged but not heated.

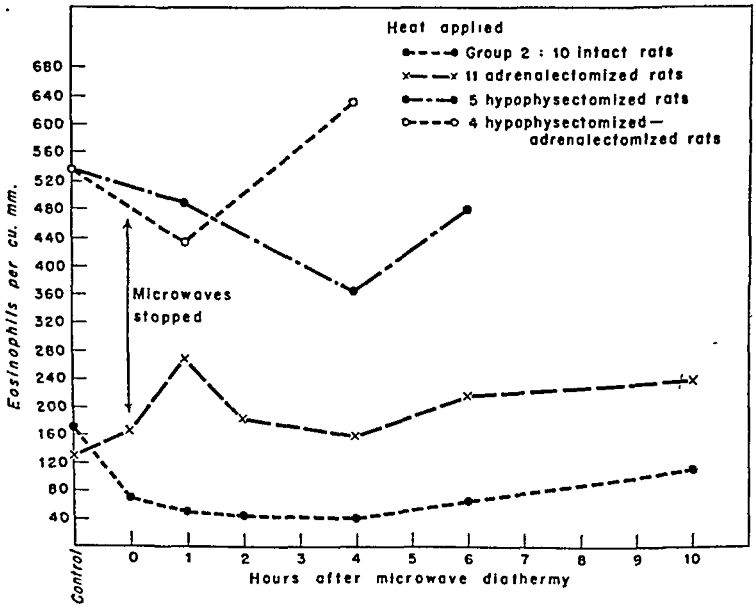

Fig. 6. — Changes in the eosinophil distributions of intact, adrenalectomized, hypophysectomized and hypophysectomized-adrenalectomized rats caged and heated for one hour.

changes were all greatly accentuated, indicating a far greater response by the mechanism which controlled the eosinophilic level in the peripheral blood. The greatest decline in the number of eosinophils occurred at four hours after the exposure to the microtherm (fig. 4), and normal values were not restored ten hours after exposure.

When the adrenal glands were removed and these animals were maintained on a high salt intake, the changes (fig. 5) in the eosinophil levels of animals which were caged only, and of those which were caged and subjected to microwave therapy for one hour, differed markedly from the changes in intact animals (fig. 4). In the absence of the adrenal glands both cage restriction and cage restriction plus the application of heat induced eosinophilia rather than eosinopenia. Reasons for this elevation in the eosinophil count, under the impact of either cage restriction or restriction plus heat, are not clear; but it may represent a discharge into the peripheral circulation of cells temporarily sequestered in various organs.

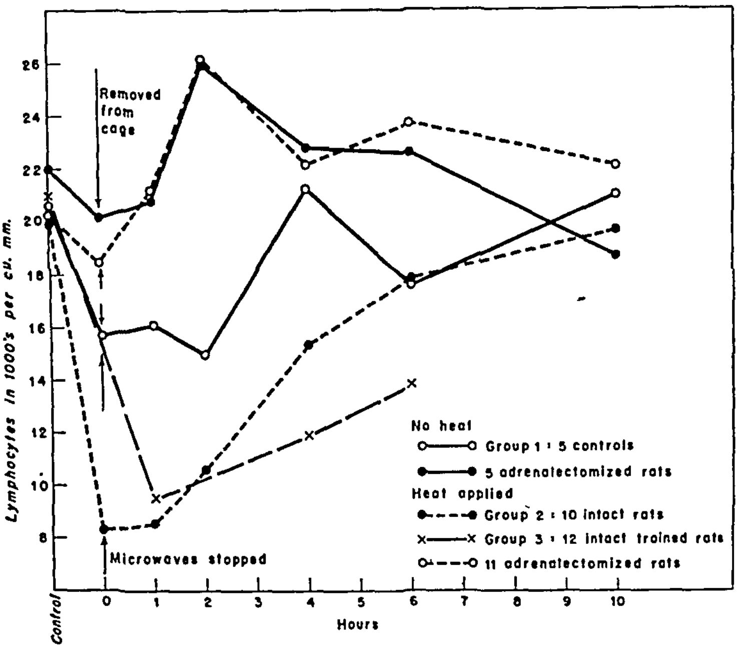

Fig. 7. — Changes in the lymphocyte distributions of intact and adrenalectomized rats with and without the applications of heat.

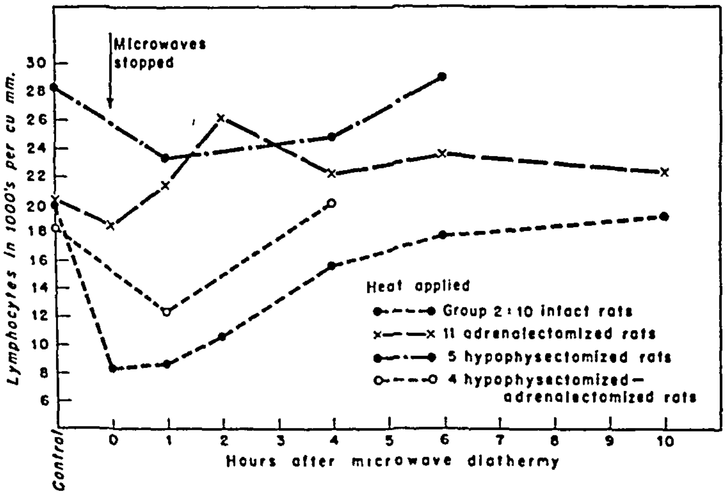

Fig. 8. — Changes in the lymphocyte distributions of intact, adrenalectomized, hypophysectomized and hypophysectomized-adrenalectomized rats caged and subjected to heat for one hour.

The changes in the eosinophil distributions incited by heat in normal intact animals, in adrenalectomized animals, in hypophysectomized animals and in hypophysectomized - adrenalectomized animals are shown in figure 6. In our experience eosinophil levels range very much higher in hypophysectomized animals than in normal animals, although the spread of the data is greater. When heat was applied to hypophysectomized animals we obtained, four hours later, eosinopenia of far less magnitude than that recorded when intact animals were heated. This may be a real eosinopenia and, if so, may well be explained by a direct effect on the atrophic adrenal cortex, thereby releasing minimal amounts of adrenal steroid, which in turn exerted some eosinophilolytic changes. The curve setting forth the changes induced by heat after both hypophysis and adrenal glands were removed (fig. 6) shows a slight decline at one hour, a decline which was statistically insignificant; but at four hours, the eosinophil level was statistically significantly higher and thereby resembled data hitherto assembled on the adrenalectomized animals.

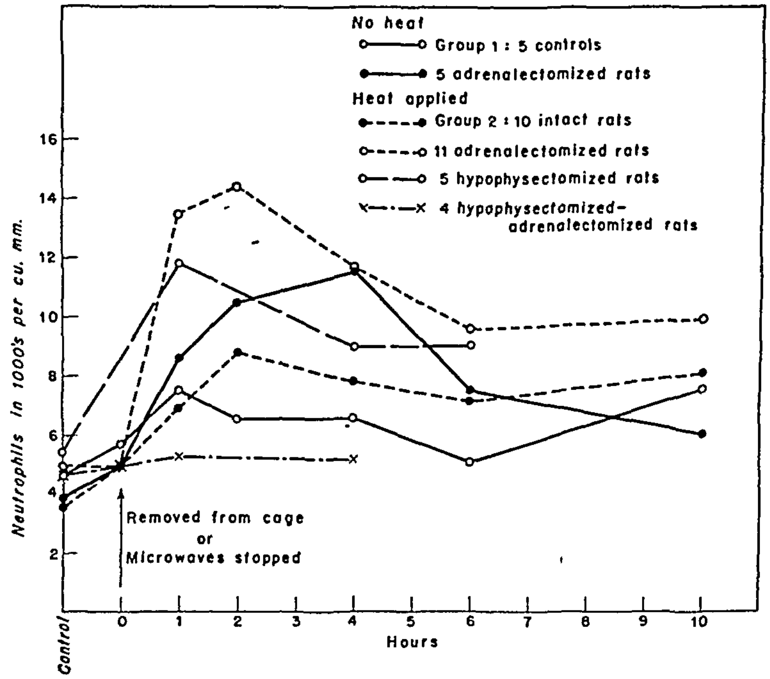

Fig. 9. — Changes in the neutrophil distributions of intact, adrenalectomized, hypophysectomized, and hypophysectomized-adrenaleectomized rats with and without the application of heat.

II. *The Mononuclear Leukocyte Response.* — The changes in the lymphocyte (including all mononuclear leukocytes) distributions in the various animals subjected to cage restriction, and to cage restriction plus the application of heat, were not unlike those changes observed for the eosinophilic leukocytes. Cage restrictions, per se, always incited lymphopenia; but when the stimulus of the heat was superimposed, the degree of lymphopenia was much greater (fig. 7). This is due, we presume, to the lymphocytolytic effects induced by the increased adrenal function incited by the stress which either caging alone, or caging plus heat, had placed on the organism. When animals were adrenalectomized and comparable stress was applied — either caging alone or caging plus heat — lymphopenia did not occur in either group (fig. 7).

When heat was applied to the hypophysectomized animals, lymphopenia did occur (fig. 8). It was transient, however, and normal distributions were recorded six hours after heating. As in the eosinopenic response, it is presumed that sufficient adrenal cortex persisted, following loss of the pituitary gland, to put out sufficient steroid hormone to incite this minimal, transient lymphopenic response. However, real lymphopenia occurred in the 4 hypophysectomized animals which were later adrenalectomized. At present we have no explanation for this change, but we believe it may be dependent on adrenal accessories. This observation should be repeated on a larger number of animals to make certain of this trend.

III. *The Polymorphonuclear Leukocyte Response.* — The peripheral distributions of the neutrophilic leukocytes in animals subjected to caging, and in those subjected to caging and to heat, are condensed and shown graphically (fig. 9). Neutrophilia occurred in all animals following either caging for one hour, or caging with added heat for one hour, except in those which had been both hypophysectomized and adrenalectomized. The degree of neutrophilia was even greater in the adrenalectomized rats subjected to heat than in the intact animals subjected to the same temperature. Both ACTH and cortisone have been shown to produce neutrophilia. In intact animals subjected to heat, it is presumed that both ACTH and cortisone were released and that both hormones exerted their effect; and yet the degree of neutrophilia was greater in those animals which were without adrenal cortices than in the intact animals. Whether larger amounts of ACTH were released by the pituitary glands in adrenalectomized animals than in intact animals remains to be demonstrated. In animals without their pituitary glands, neutrophilia followed the application of heat to a degree nearly as marked as that which followed when adrenalectomized animals were heated to the same temperatures. When animals were without both adrenal glands and pituitary glands, then, and then only, did neutrophilia fail to occur.

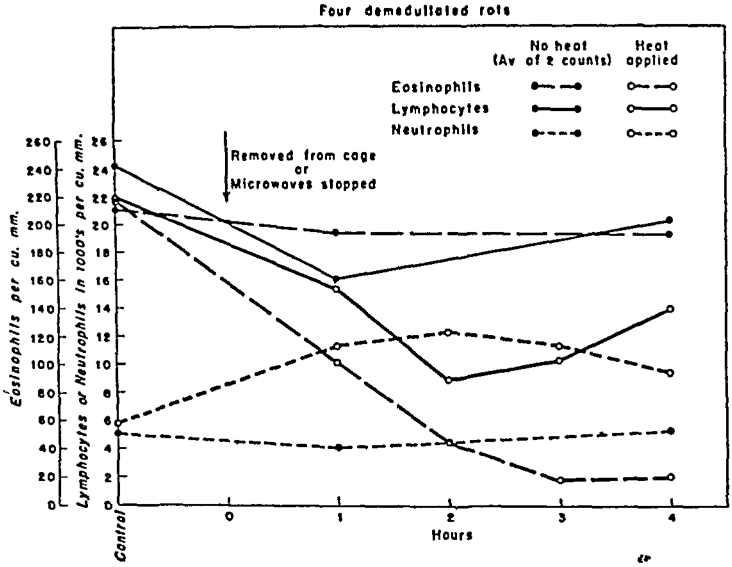

Fig. 10. — Changes in the eosinophil, lymphocyte and neutrophil distributions in 4 adrenal-demedullated rats, with and without the application of heat.

IV. *The Response in Demedullated Animals.* — To test the role of the adrenal medulla in the sequence of events which incite changes in these various blood categories following heating, we enucleated both adrenal glands in a small series of animals, thereby removing all medullary tissue, the source of epinephrine. After recovery these animals were subjected to heat in exactly the same manner as before, and the blood categories were examined at the corresponding intervals thereafter. Data are portrayed in figure 10. It seems clear that the changes observed were comparable to those described in normal intact anmals. However, caging per se did not appear to exert quite the degree of response in the adrenal-demedullated animal as was shown to occur in the intact animal. Caging induced neither eosinopenia nor neutrophilia, although lymphopenia did occur. However, when these same animals were caged and heated, marked eosinopenia, marked lymphopenia and marked neutrophilia did occur. It would appear that the adrenal medulla may function in the train of events which occurs within the organism after mild stress. But when stress was accentuated, as in heating, the adrenal medulla was not essential to the systemic reactions which ensued.

Conclusions

1. Hyperthermia induced a characteristic hematologic picture in intact male rats. This consisted of eosinopenia, lymphopenia and neutrophilia.
2. Hyperthermia did not incite eosinopenia or lymphopenia in adrenalectomized rats. Therefore it is postulated that these trends, when observed in intact animals, indicate adrenocortical stimulation.
3. Hypophysectomized rats showed the same trends following hyperthermia as intact animals. Quantitatively, however, the eosinopenia and lymphopenia were much less. It may well be that the high temperatures stimulated adrenal secretion even in the absence of the pituitary.
4. Since hyperthermia was capable of inciting neutrophilia in either adrenalectomized or hypophysectomized but not in hypophysectomized-adrenalectomized animals, it is postulated that either adrenocortical hormone or pituitary hormone had induced the outpouring of neutrophilic leukocytes into the peripheral blood.
5. The adrenal medulla was not essential to the production of the characteristic hematopoietic response to elevated body temperature.

Discussion

Dr. Frederic T. Jung (Chicago): This paper deserves commendation because it deals with a problem of general physiological interest, namely, the association of a certain type of hemogram with fever, because it deals with the timely problem of the action of ACTH and cortisone; and because controls have been used to eliminate the effects, for instance, of restraint of the experimental animals.

In Fig. 9, attention is called in the accompanying remarks to the fact that the number of animals used in the hypophysectomized - adrenalectomized group was small, and that "one would hesitate to rely too heavily" on the unexpected and unexplained findings that are reported there.

The double operation must be a severe strain upon the organism, and one wonders whether hypophysectomized - adrenalectomized animals are capable of reacting to any sort of stimulus as vigorously as animals upon which no operation had been performed. It would be worthwhile to state how long a time had elapsed after completion of the second stage of the double operation, and to describe the general condition of the animals.

One way to "control" this aspect of the work would be to use sham operations, in which the control animals would be subjected to all the anesthetic and surgical trauma of the two extirpation operations, while leaving the organs *in situ*.

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EFFECT OF MASSAGE ON MUSCLE TEMPERATURE AND RADIOSODIUM CLEARANCE *

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History

Massage has been known and practiced by members of the healing profession since ancient times. In the Indian Vedas,[1] which are believed to have their origin about 1800 B. C., references are made to procedures which can readily be interpreted as forms of massage carried out for therapeutic purposes. Notwithstanding this background in antiquity, it was not until the latter part of the nineteenth century that attempts were made to investigate the effects of massage scientifically. Apparently the first physiologic experiment to determine the value of this procedure was performed by von Mosengeil[2] in 1876, who injected India ink into knee joints of rabbits and then massaged these joints. He found that the ink was dispersed into adjacent tissues, and drew the conclusion that massage had a beneficial effect upon the resorption of inflammatory products in the joint. This same worker also postulated the salutory effects of massage upon the venous circulation,[3] and also was the first to show that massage produced a rise in temperature of the treated skin of 0.25 to 3 degrees centigrade.[4]

In 1877 Lassar[5] demonstrated that lymph flow was influenced by massage. He inserted a glass cannula into a lymph trunk of a dog's leg and determined the normal rate of flow to be a mere drop in ten minutes, while with massage it was possible to collect a few cubic centimeters of lymph with great ease and within a short period of time. He showed further that in an inflamed leg the flow of lymph was greater than normal and was further augmented by massage.

In the following decade Zabludowski[6] carried on extensive investigations in an attempt to evaluate the effect of massage. His work was not held in high esteem by his contemporaries. His experiments were apparently done in a careless manner and his conclusions were based on inadequate and poorly controlled observations. Zabludowski studied the effect of massage on body weight, muscle power, body temperature, pulse rate, respiratory rate, urine volume, urinary nitrogen, phosphorus and sulfur excretion, blood pressure, and on the number of daily bowel evacuations.

Eccles[7] in 1885 showed that the effects of body massage varied with the location of the massage. Treating the trunk and extremities for 30-45 min-

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* From the Physical Medicine and Rehabilitation Service, and the Radioisotope Unit, Bronx Veterans Administration Hospital.

* Reviewed in the Veterans Administration and published with the approval of the Chief Medical Director. The statements and [illegible] by the authors are a result of their own studies and do not necessarily reflect the [illegible] Veterans Administration.

[1] Rosenthal, C.: Die Massage und ihre Wissenschaftliche Begruendung. Berlin, 1910, p. 1.

[2] von Mosengeil: Ueber Massage, deren Technik, Wirkung, und Indikationen. Arch. f. klin. Chirurgie, 19, No. 3 and 4, 1876.

[3] von Mosengeil, op. cit.

[4] von Mosengeil, op. cit.

[5] Lassar, O.: Ueber Oedem und [illegible] tzuendung, Virch. Arch. 69:518, 1877.

[6] Rosenthal, C.: Die Massage un [illegible] Begruendung. Berlin, 1910, p. 2.

[7] Eccles, A. S.: Observations on Physiological Effects of Massage, Proc. Roy. Soc. Med., London, 1885-87.

utes produced a rise in surface temperature and a fall in rectal temperature; but massaging the abdomen had the reverse effect. Rosenthal[8] investigated these results further and came to the conclusion that any increase in skin temperature was largely the result of friction and was not caused by increased circulation. He also showed that the elevation in skin temperature was very fleeting, since it fell to almost pre-treatment level within thirty seconds.

Physiologic Basis

The earliest investigations of the physiologic effects of massage upon muscle were carried out by Zabludowski,[9] whose primary contribution lay in establishing its beneficial effect upon muscle fatigue. In his experiments a muscle was completely fatigued by electric stimulation, and was then either rested or massaged for a period of ten minutes. The threshold of excitability was always lower in the massaged muscle. He interpreted this as being due to speeding up of the circulation, which thereby aided in the more rapid removal of so-called fatigue substances such as carbon dioxide and lactic acid. This explanation was challenged by Maggiore,[10] who showed that massage of rested muscle also increased its activity and energy. He believed, therefore, that the effect could not be attributed to the removal of fatigue substances, but was probably the result of the augmented circulation per se. This was further substantiated by Hans Ruge[11] in 1903 in his studies of the effect of massage on the work capacity of muscle with circulation intact, as compared to muscle deprived of its circulation. He found that after fatiguing exercise a muscle with intact circulation was able to perform 80 per cent more work after massage than following a period of rest of equal duration. The muscle without circulation reacted similarly during the early period of the experiment, but then became weaker through massage than the muscle treated only with simple rest. These results were interpreted to indicate the need for an intact circulation to permit the beneficial effects of massage.

On theoretical grounds von Mosengeil[12] postulated in 1876 that massage increases the circulation to the massaged part. He argued that since massage causes a more rapid emptying of the venous and lymphatic circulation of the massaged part, the blood must of necessity be replaced by an increased blood flow in the arterial circulation supplying that part. As mentioned earlier, Lassar demonstrated a marked increase in lymph flow in dogs following massage and inflammation. Zabludowski, using a crude arm plethysmograph, was able to demonstrate increased blood flow in a forearm contained in the plethysmograph while massaging the other arm, or even a lower extremity. Lehmann[13] in 1899, using improved techniques, showed that psychologic factors alone were able to produce variations in the volume of the forearm and thereby cast doubt on Zabludowski's claims regarding the effect of massage on blood flow. Rosenthal[14] later showed by more refined instruments that the volume of an arm completely fatigued by exercise dropped to normal almost immediately, while this reduction in limb volume was delayed by massage.

The first direct measurements of the effect of massage upon blood flow were carried out by Friedel Pick.[15] By repeated phlebotomies he defibrinated the entire blood content of experimental dogs. He then inserted a cannula into the femoral vein, which was connected to a calibrated burette by means of which he was able to measure the time required for a stated amount of blood to flow through the femoral vein. He found that effleurage caused a decided increase in venous blood flow of the massaged extremity, which effect lasted only during the period of massage. In contrast, tapotement not only caused a similar increase in blood flow, but this increased flow was maintained for a considerable period after massage had been stopped. The same results were obtained with petrissage. He concluded from these experiments that effleurage produced increased venous blood flow through mechanical means, whereas tapotement and petrissage caused an increase in blood flow through reflex dilatation of the vessels of the massaged muscle and skin.

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[8] Rosenthal, C.: Die Massage und ihre Wissenschaftliche Begruendung. Berlin, 1910, p. 18.

[9] Zabludowski, J.: Quoted by Rosenthal, C.: Die Massage und ihre Wissenschaftliche Begruendung, Berlin, 1910, p. 36.

[10] Maggiore: Quoted by Rosenthal, C.: Die Massage und ihre Wissenschaftliche Begruendung, Berlin, 1910, p. 40.

[11] Ruge, H.: Physiologisches ueber Muskelmassage nebst einigen therapeutischen Bemerkungen, Zeitschr. f. physikal. u. diet. Therapie, 1902/3, No. 3.

[12] von Mosengeil: Ueber Massage, Arch. f. klin. Chir. 19: No. 3, 1876.

[13] Lehmann: Quoted by Rosenthal, C.: Die Massage und ihre Wissenschaftliche Begruendung, Berlin, 1910, p. 55.

[14] Rosenthal, C.: Die Massage und ihre Wissenschaftliche Begruendung, Berlin, 1910, p. 56.

[15] Pick, F.: Verhandlungen des Kongresses fuer Innere Medizin, XX, Wiesbaden.

At the present time there is no satisfactory method of determining muscle blood flow in man directly. In 1939 Mayerson and Toth[16] used a specially constructed thermocouple, consisting of a long steel needle with insulated shaft, with which they recorded temperatures of the subcutaneous tissues and muscle. The following year the same technique was used by Friedlander, et al.[17] to determine the effect of various drugs and procedures upon skin and muscle blood flow simultaneously, stating that an increase in muscle temperature reflected increased circulation.[18] This claim has not been entirely accepted, since under certain conditions other factors might be responsible for the increased temperature, cutaneous vasoconstriction might prevent loss of some of the heat arising in muscles, and alterations in muscle metabolism could conceivably affect the rate of heat production without altering the circulation to the same degree. More recently the rate of clearance of radioactive sodium from the tissues has been used as an index of circulation.[19] While this method is still in the experimental stages, and is not universally accepted, the authors believe that it does adequately measure effective blood flow in tissues.[20] One of the objections to the method is that spasm of vessels may occur as a result of the injection.[21] In our experience such spasm does not last longer than four to six minutes, and readings of the activity recorded for this time interval are compensated in plotting the curve.[22] Another criticism of this technique recently published[23] is not considered valid, since the authors in their studies neglected to take off background readings, did not consider the possibility of vascular spasm, and recorded activity for only ten minutes which may give entirely false results. Furthermore, these investigators used needles two centimeters in length, which will not reach muscle in many subjects of robust physique.

In our studies of the effect of massage upon muscle blood flow we have used both of these methods in an attempt to determine the value of massage as a therapeutic procedure for increasing circulation in muscle. Bierman,[24] using the thermocouple technique, has found evidence that circulation in muscle is increased, but he gives no quantitative data. It was our purpose

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16. Mayerson, H. S., and Toth, L. A.: The Influence of Posture on Skin and Subcutaneous Temperatures, Am. J. Physiol. 125:474, 1939.

17. Friedlander, M.; Silbert, S., and Bierman, W.: Regulation of Circulation in Skin and Muscles of the Lower Extremities, Am. J. Med. Sc. 199:657, 1940.

18. Friedlander, M.; Silbert, S.; Bierman, W., and Laskey, N.: Differences in Temperature of Skin and Muscles of the Lower Extremities Following Various Procedures, Proc. Soc. Exp. Biol. & Med. 38: 150, 1938.

19. Kety, S. S.: Measurement of Regional Circulation by the Local Clearance of Radioactive Sodium, Am. Heart J. 38:321, 1949.

20. Wisham, L. H.; Yalow, R. S., and Freund, A. J.: Consistency of Clearance of Radioactive Sodium from Human Muscle, Am. Heart J. 41:810, 1951.

21. Mufson, I.: Response of the Abnormal Arterial Circulation to Various Stimuli, as Studied by the Use of Radioactive Sodium, Ann. Int. Med. 34:428, 1951.

22. Wisham, L. H., and Yalow, R. S.: Some Factors Affecting the Clearance of Na^{21} From Human Muscle, Am. Heart J., 43:67, 1952.

23. Miller, H., and Wilson, G. M.: The Measurement of Blood Flow by the Local Clearance of Radioactive Sodium, Brit. Heart J. 13:227, 1951.

24. Bierman, W.: Physical Medicine in General Practice, 2nd Ed., Hoeber, New York, 1947.

in this study to determine, if possible, the degree to which circulation can be augmented by massage alone.

Method I. Muscle Temperature

Ten test subjects were used, all being patients in a general medical-surgical hospital. All patients were free of any clinical evidence of peripheral vascular disease. The Leeds and Northrop multiple channel electric recording thermocouple "SPEEDOMAX" was used. One of the eight available leads was connected directly to a needle muscle thermocouple, and all leads used were tested for accuracy against known temperatures. The subject being tested was placed prone on a plinth. An area of skin over each calf, with its underlying subcutaneous tissue, was infiltrated with procaine. Skin thermocouples were then fastened on the skin of each calf immediately adjacent to the injection site, and the muscle thermocouple was inserted into the belly of the gastrocnemius muscle to be massaged through the anesthetised skin. The subject was permitted to rest until all temperatures were stabilized. The needle thermocouple was then withdrawn and inserted into the other calf muscle, while the skin thermocouple was removed from the calf which was to be massaged. A ten minute massage, using kneading and deep stroking, was then administered to the test calf. After the massage the muscle thermocouple was withdrawn from the nontreated side and immediately inserted into the massaged calf muscle. The skin thermocouple was re-applied to the massaged calf. Room temperature was recorded continuously, and mouth temperature, pulse, and blood pressure were recorded immediately before and after massage.

Method II. Radiosodium Clearance

The subjects for this part of the investigation were six males and one female, none of whom had clinical evidence of peripheral vascular disease. The subjects were permitted to lie supine for ten to fifteen minutes in a room in which the temperature was maintained between 75-80 degrees F. An injection of 0.1 cc. of isotonic sodium chloride solution containing between one and three microcuries of radioactive sodium (Na^{24}) was then made into the belly of the gastrocnemius muscle with a 20 gauge 1½ inch needle. The needle was inserted to the hilt.

A thin mica-window Geiger counter coupled to an automatic register was placed in position over the injection site and recordings of the radioactivity present were taken at intervals of two minutes for one hour. This procedure was done twice on every subject, once as a control, and a second time on the following day immediately after a ten minutes massage had been administered. Calculations of the clearance rates were then made as described in a previous report by one of the authors (LHW[25]). Results are expressed in clearance constants and in half-life. The half-life is the time required for the activity to reach half its initial value. The clearance constant is derived from the formula $K \text{ (clearance constant)} = \frac{0.693}{T\frac{1}{2} \text{ (half-life)}}$.

Findings

Of the ten subjects tested with the muscle thermocouple, five showed no change in muscle temperature on the massaged side. One of these five, however, showed a gradual rise of 0.7 degrees F. during the five minute period following conclusion of the massage. Of the remaining five subjects one

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[25] Wisham, L. H.; Yalow, R. S., and Freund, A. J.: Consistency of Clearance of Radioactive Sodium from Human Muscle, Am. Heart J. 41:810, 1951.

TABLE 1. — *Muscle Temperatures.*

#	NAME	DATE	ROOM TEMP.	ORAL TEMP.		BLOOD PRESSURE		PULSE		MASSAGED MUSCLE		NON-MASSAGED MUSCLE		MASSAGED SKIN		NON-MASSAGED SKIN		DURATION OF EFFECT (IN MINUTES)			REMARKS
				BEFORE MASSAGE	AFTER MASSAGE	BEFORE MASSAGE	AFTER MASSAGE	BEFORE MASSAGE	AFTER MASSAGE	BEFORE MASSAGE	AFTER MASSAGE	BEFORE MASSAGE	AFTER MASSAGE	BEFORE MASSAGE	AFTER MASSAGE	BEFORE MASSAGE	AFTER MASSAGE	MASSAGED MUSCLE	MASSAGED SKIN	NON-MASSAGED SKIN	
1	EC	1-3-51	76	98.6	98.0	138/90	136/90	72	68	95.0	95.0	96.3	96.0	89.3	92.0	87.3	87.0	—	1.5	—	
2	JM	1-4-51	76	99.0	98.6	130/70	130/68	80	78	98.3	98.5	99.0	99.0	91.0	92.5	92.5	94.5	20	2	1	
3	JD	1-4-51	76	98.2	97.0	126/90	140/98	92	88	97.5	97.0	97.5	97.7	95.0	95.5	95.0	94.0	—	10+	—	
4	CB	7-20-51	78	98.4	98.0	106/80	106/80	72	72	97.0	97.0	96.7	96.7	88.0	91.5	91.3	92.0	12	GRADUAL DECLINE OF TEMPERATURE OVER 7 MIN.	9	
5	SW	7-20-51	77.5	97.8	98.0	140/78	140/78	90	90	95.0	96.0	96.5	96.5	88.0	93.0	89.0	90.0	TEMP. ROSE TO 97.0 DURING NEXT 12 MINUTES	TEMP. ROSE TO 94.0 OVER 12 MIN. PERIOD	3	TEMPERATURE 97.0 AT COMPLETION OF TEST 15 MINUTES AFTER MASSAGE ENDED
6	AC	7-24-51	81	98.2	98.4	150/104	158/110	112	114	97.7	97.7	97.5	97.5	89.0	92.0	91.5	92.5	—	POST MASSAGE TEMPERATURE MAINTAINED 15 MINUTES	GRADUAL RETURN TO PRE-MASSAGE LEVEL IN 19 MIN	SKIN TEMPERATURE GRADUALLY RETURNED TO PRE-MASSAGE LEVEL OVER 16 MINUTE PERIOD
7	PM	7-24-51	81	98.6	98.6	112/70	110/74	84	84	94.3	95.0	98.5	96.5	88.5	92.0	88.0	88.7	9+	9+	9+	
8	AN	7-25-51	83	98.2	98.0	110/78	108/74	90	94	97.6	97.6	*		94.5	95.5	93.0	94.0	—	10+	8	*MUSCLE TEMPERATURES OF NON-MASSAGED SIDE DISCONTINUED BECAUSE OF NEGLIGIBLE EFFECT
9	LM	7-25-51	83	98.6	98.6	138/80	136/80	96	94	98.5	98.3			91.7	94.0	93.5	93.0	—	GRADUAL DECLINE TO PRE-MASSAGE LEVEL IN 25 MIN	—	
10	JH	7-26-51	83.5	98.4	98.4	116/60	118/60	84	84	98.0	98.0			94.3	96	92.0	93.0	—	9+	4	

showed a rise of 0.2 degrees, and one a rise of 0.7 degrees; one patient registered a fall in temperature of 0.2 degrees, and one a fall of 0.5 degrees. The one remaining subject showed an increase in muscle temperature of one degree F. immediately following the massage, and during the twelve minutes after conclusion of massage a gradual rise in muscle temperature of one additional degree took place. This rise was still evident when the test was concluded several minutes later.

The temperatures of the non-massaged calf muscles showed no remarkable changes except in one subject (Table 1) whose non-massaged calf muscle recorded a gradual two degree fall during the ten minute period while the other calf was being massaged.

With the radiosodium clearance method the tests showed no appreciable changes in blood flow following massage as compared to the control clearance. Two of the subjects showed a slight increase (Table 2) in effective blood *flow, four of the subjects showed a slight decrease following massage, and* one showed no change. However, all these changes are within the experimental error of the technique, variations from a mean figure being usually ± 20 per cent.[26]

TABLE 2. — *Radiosodium Clearance.*

Subject	—Clearance Constant (K) Min.$^{-1}$—		—Half Life in Minutes—	
	Control	Post-Massage	Control	Post-Massage
1 FW	.0925	.1026	7.5	6.75
2 JL	.0867	.0840	8.0	8.25
3 BW	.0991	.0991	7.0	7.0
4 NB	.0991	.1108	7.0	6.25
5 MV	.0840	.0792	8.25	8.75
6 LW	.0867	.0792	8.0	8.75
7 AE	.0956	.0925	7.25	7.5

The changes found by us were all within these limits. It should be understood, however, that any increase in blood flow which might take place during massage would not be shown with this technique.

Other incidental findings, although not directly the object of this investigation, were the skin temperature changes. It was noted that the massaged skin showed considerable temperature elevations, ranging from a minimum rise of 0.5 degrees to a maximum of 6 degrees, the average being 2.6 degrees. It was also noted that the increase in temperature was maintained for a considerable period of time, from a low of 1½ minutes to a high of twelve plus minutes. This finding is at variance with the results reported by Rosenthal, who stated that the rise in temperature is very fleeting, lasting for some thirty seconds only. An effect was also noted upon the skin of the non-massaged calf. A moderate rise in temperature was observed to begin two to three minutes after massage of the opposite calf was begun. This rise was short-lived, lasting in most instances only four to five minutes, and averaging only 0.5 degree. The oral temperature showed minimal variations, as did the pulse rate. Blood pressure in one subject showed an increase of 14 mm. Hg. systolic, and in another 8 mm. Hg. systolic, with commensurate changes in the diastolic pressure; in all other subjects blood pressure readings before and after massage were within two to four millimeters of each other. (See Table 1.)

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[26] Wisham, et al., op. cit.

Conclusions

Massage is not an effective method for increasing blood flow to muscle as determined by muscle temperature studies and clearance of radioactive sodium from muscle. Only one subject out of ten showed any significant rise in muscle temperature following massage, and none of the subjects tested by the radiosodium technique showed evidence of increased muscle circulation as a result of massage.

The value of massage for increasing circulation to the skin is confirmed, and it was further established that the effect produced by massage is of longer duration than previously reported. A slight increase in skin temperature was also observed in the opposite limb, lasting for several minutes only, and probably reflex in nature.

Summary

Ten subjects were studied to determine the effect of massage upon muscle temperature, and seven subjects were studied to determine the effect of massage upon muscle blood flow by means of the radioactive sodium clearance technique. The results of these studies are presented.

The authors wish to thank Dr. K. Harpuder, Senior Consultant in Physical Medicine and Rehabilitation and Peripheral Vascular Diseases, Bronx Veterans Administration Hospital, for his advice and suggestions, and to Dr. Arthur S. Abramson, Chief, and Dr. Bernard Stoll, Assistant Chief, Physical Medicine Rehabilitation Service, Bronx Veterans Administration Hospital, for their guidance in the preparation and editing of this paper. Thanks are also due to Mr. Morris Vogel, Chief, and Mr. Larry Weinstein, Assistant Chief, Physical Therapy Section, Bronx VA Hospital, for the administration of the massage to the subjects who participated in this study, and to Miss Birdie Cooper for the preparation of the manuscript.

Discussion

Dr. Jerome Weiss (Brooklyn, N. Y.): This excellent paper by Drs. Ebel and Wisham represents a definite advance in our better understanding of the physiology of Physical Medicine. Its preparation has entailed a vast amount of work and it arrives at conclusions which would be difficult indeed to challenge. At first an impression is felt that the largely negative results shown constitute a lessening of the value of massage. It has repeatedly been stated by others that it is impossible to massage a muscle without also massaging the overlying skin. The skin contains highly sensitive receptor nerve ends. These nerve ends connect with both the central and the sympathetic nervous systems. It is difficult to localize the effects of massage, because of the widespread connections of the nervous system. Hence, increased blood flow becomes of minor importance in estimating the overall benefits of massage. The reflex value of massage is probably the most important of all. From this point of view, we may retain a conventional estimate of the merits of massage. The essayists have wisely avoided denial of these general benefits.

INCIDENCE OF PAIN IN IDIOPATHIC SCOLIOSIS

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Idiopathic scoliosis is generally recognized as a self-limiting deformity In practically all cases the scoliosis stops progressing between the ages of 13 and 19 years or when the spinal column stops growing.[1-3] The equilibrium so established is then maintained or altered slightly according to the plasticity of the bone.[4] The chief concern of most physicians during this formative period is the resultant cosmetic deformity. Pain is a relatively insignificant factor during this period of growth. However, as these patients approach middle age many of them complain of backaches of varying severity and duration.

Very limited information can be gleaned from the extensive literature relative to the actual incidence of pain in idiopathic scoliosis. James[5] has stated that in a series of 353 patients, representing all types of scoliosis, 69 complained of pain and 59 had idiopathic scoliosis. In a review of 425 cases of idiopathic scoliosis in 1941 by the Research Committee of the American Orthopaedic Association[6] pain was mentioned as a chief complaint in only 8 per cent of the cases.

The present study was undertaken to determine (1) the incidence of pain in idiopathic scoliosis in various age groups, (2) the patient's age at the onset of pain, and (3) any possible correlation between the severity of the pain and the location and degree of the major curve.

Of 324 consecutive cases of all types of scoliosis of varying severity diagnosed by roentgenography at the Mayo Clinic during the first four months of 1941, 249 cases were judged to be idiopathic in origin and nature. All cases in which the patients were 50 years of age or more were discarded, since the incidence of other recognized causes of pain becomes quite high in this age group; this discarded group was composed of 126 cases of scoliosis, of which 94 were idiopathic. Of the remaining 155 cases of idiopathic scoliosis under the age of 50 years, 23 were discarded because they had concomitant conditions which are recognized causes of pain. The remaining 132 cases of idio-

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1. Steindler, Arthur: Mechanics of Normal and Pathological Locomotion in Man Springfield, Illinois, Charles C Thomas, 1935, p. 209.
2. Cobb, J. R.: Treatment of Scoliosis, Connecticut M. J. 7:467 (July) 1943.
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pathic scoliosis under the age of 50 years were considered to have no other recognizable cause for pain and constitute the group of cases on which this study was based.

TABLE 1. — *Age and Sex Distribution of Patients Having Idiopathic Scoliosis, 1941.*

	Both Sexes		Male		Female	
Age, Year	Number	Per Cent	Number	Per Cent	Number	Per Cent
10-19	14	10.6	4	7.4	10	12.8
20-29	25	18.9	8	14 8	17	21.8
30-39	38	28.8	16	29.6	22	28.2
40-49	55	41.7	26	48.2	29	37.2
Total	132	100.0	54	100.0	78	100.0
Per cent of total	100.0		40.9		59.1	

The age and sex distribution of the 132 patients studied is shown in table 1.

Eighty-six patients (65.2 per cent) complained of some degree of pain at the time of their examination in 1941. A much higher percentage of patients in the older age groups complained of pain than of those in the younger age groups (table 2). Also, almost exactly the same percentage of males complained of pain as did females.

TABLE 2. — *Incidence of Pain by Age and Sex of Patients Having Idiopathic Scoliosis, 1941.*

	Both Sexes			Male			Female		
		With Pain			With Pain			With Pain	
Age, Year	Total	Number	Per Cent	Total	Number	Per Cent	Total	Number	Per Cent
10-19	14	5	35.7	4	2	50.0	10	3	30.0
20-29	25	14	56.0	8	2	25.0	17	12	70.6
30-39	38	28	73.7	16	11	68.8	22	17	77.3
40-49	55	39	70.9	26	20	76.9	29	19	65.5
Total	132	86	65.2	54	35	64.8	78	51	65.4

The pain was located in the back, the shoulder girdle, the scapular area, the region of the sacro-iliac joints, and the hips. Most of the pain was an ache located in the lower part of the back. The severity of the pain was classified as mild, moderate, or severe, according to arbitrary criteria. Mild pain was defined as pain of a transitory nature or an aching for a period of less than twelve months' duration but greater than one month's duration; moderate pain as sharp pain of short duration, recurrent radiating pain, or aches of twelve months' or more duration; severe pain as including any incapacitating pain and all constant sharp pain or aches. Using these criteria it was found that, in 1941, 19 patients had mild pain, 63 patients had moderate pain, and 4 had severe pain. The preponderance of moderate and severe pain was found to occur after the age of 20 years, the major incidence of pain in patients under the age of 20 years being classed as mild.

Ten years later, in 1951, we were able to trace only 76 of these 132 patients. From the follow-up letters it is evident that the severity of the pain did not change appreciably in the intervening ten years in those patients who had pain in 1941. In a few cases the pain had improved; but, for the most part, patients reported that the pain was essentially the same as it was in 1941. It is perhaps quite significant that nearly 50 per cent of the 26 traceable patients who did not have pain in 1941 complained of either a mild or a moderate degree of pain by 1951.

The patient's age at the onset of pain was determined for the 98 patients who had pain by 1951 (table 3). The onset of pain was greatest in the group aged 30 to 39 years, and this age group accounted for 36 per cent of all patients in whom pain developed. This is the same percentage as in James' series of cases.[5] He stated that in 12 (36 per cent) of 33 cases in which there was pain the pain developed between the ages of 30 and 39 years.

TABLE 3. — *Age at Onset of Pain.*

Age, Year	Both Sexes	Male	Female
10-19	13	6	7
20-29	24	4	20
30-39	35	19	16
40-49	26	12	14
Total	98	41	57

TABLE 4. — *Degree of Pain Related to Degree of Scoliosis.*

Degree of Pain	Degree of Scoliosis* Mild	Moderate	Severe
None	32	8	6
Mild	19	0	0
Moderate	57	4	2
Severe	0	1	3
Total	108	13	11

* *Mild scoliosis was a major curve of less than 15 degrees; moderate scoliosis, 15 degrees to 30 degrees; severe scoliosis, more than 30 degrees.*

From table 4 it can be seen that there is little or no correlation between the severity of the scoliosis and the severity or even the incidence of associated pain. The incidence of pain, however, is appreciably higher in cases of lumbar and thoracolumbar curves than it is in cases of cervicothoracic, thoracic, or combined thoracic and lumbar curves.

Summary

One hundred thirty-two cases of idiopathic scoliosis were studied from the standpoints of (1) incidence of pain, (2) age of patient at onset of pain, and (3) severity of pain.

When they were examined in 1941, 65.2 per cent of these patients were found to have pain of some degree.

Approximately 50 per cent of the 26 traceable patients who did not have pain in 1941 complained of some degree of pain in 1951.

More patients (36 per cent) noted the onset of pain between 30 and 39 years of age than during any other decade of life.

There appeared to be no good correlation between the degree of the scoliosis and the severity of the associated pain.

THE NATURE AND TREATMENT OF FIBROSITIS *

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LONDON

Some two or three years ago, I was asked to take part in a joint investigation into a treatment of fibrositis, for which extensive claims were made; when these were first shown to me, I was very skeptical. However, we all felt that even a negative result would not be wasted, and as the investigation proceeded, we became more and more impressed with the results that were obtained.

The original technique was worked out by Dr. G. Laughton Scott, who claimed that, over a period of years, by using local injections consisting of 5 parts Benzyl Salicylate, 5 parts Camphor, and Arachis Oil to 100, he had found that not less than 60 per cent of cases could be classified as symptom free, or much improved, that disability time was shortened, that the results were better, and more persistent than those of other methods in use at present, and that beneficial results depended on close adherence to the technique.

Method

His method consisted essentially in laying down a carpet of the injected material close to the origin of the affected muscle. Fig. (1), shows on the skeleton the site of injection for pain at the lumbo-sacral junction. Figs. (2) and (3) show the sites for pain in the lower lumbar and gluteal areas.

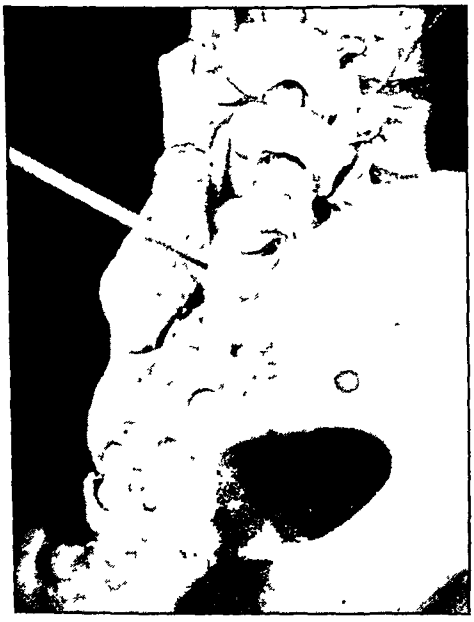

Fig. 1. — Injection Sacro iliac sulcus

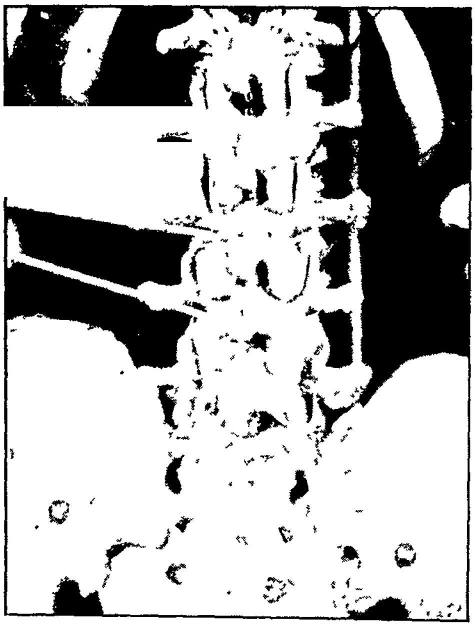

Fig. 2. — Injection: Bodies of L3 and L4 vertebrae.

The immediate and follow-up results greatly exceed my expectations, being briefly as follows: four workers averaging fifty cases each secured the final figures of 78.5 per cent symptom free or much improved, 18 per cent

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† Doctor Physical Medicine, Physician in Charge, Medical Rehabilitation Unit, The Royal Free Hospital, and Hampstead General Hospital

slightly improved or unchanged, and 3.5 per cent become worse.

All these cases were followed for a minimum of six months, and the following standard approach was used by all the investigators to ensure uniformity.

Each was responsible for the selection of cases, differential diagnosis and recording the results obtained. Each case was assessed at the completion of the course of treatment, and again at the end of six months. To ensure that Dr. Laughton Scott's exact technique was followed, it was arranged that he should carry out the great majority of treatments himself. The method of assessment used was to classify cases into five categories: Symptom free (A), Much improved (B), Slightly improved (C), No change (D), and Worse (E). For simplicity of presentation of results, A & B, and C & D were amalgamated.

Agreement was reached between all the investigators as to the areas to be treated, and the symptoms and physical signs to be accepted. These were as follows — symptoms, pain consistent in type and localization, associated with stiffness of movement, and often with definite periods of remission. Physical signs consisted of tenderness accurately localized, corresponding closely and anatomically accurately with the symptoms. Areas of palpable muscle spasm corresponding to these gave further confidence that the patient was not a psychosomatic case

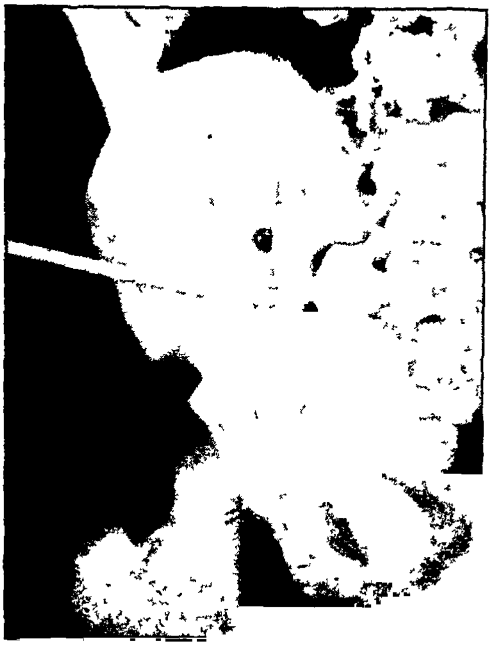

Fig 3. — Injection Sacro sciatic notch.

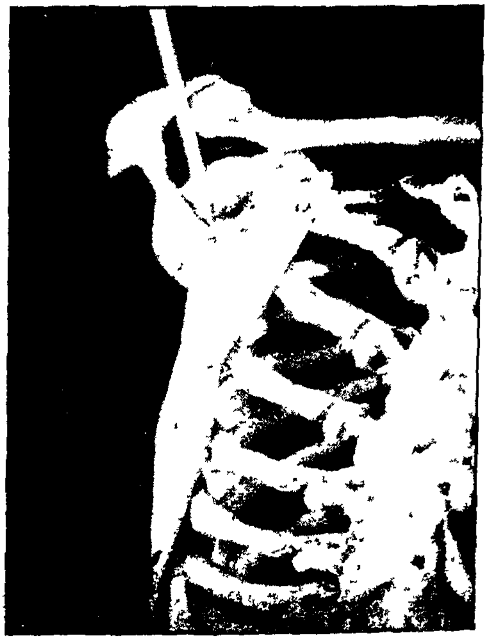

Fig. 4. — Injection: Supra scapular notch

In all the cases great care was taken to exclude conditions such as prolapsed intervertebral disc and Copeman's fibro-fatty tumor, when these might cause a closely similar syndrome. Despite these precautions, however, errors in diagnosis occurred, necessitating the rejection of some 14 per cent of cases after treatment had commenced.

The treatment used consisted of the injection of 5 ml. of benzyl salicylate mixture at weekly intervals, unless the commonly resulting malaise lasted more than 24 hours. In such cases, the next injection was deferred a week, or the amount reduced. In this respect it should be noted that all observers agreed that the appearance of this general malaise was a favorable sign, and was usually followed by a good result.

Each of the four series was carried out at a different hospital and in widely separated areas, Dr. Cowan's being at Sunderland, Mr. Plewes' at the Luton and Dunstable Hospital, Dr. Heald's at the Arthur Stanley Institute, London, and mine at the Royal Free Hospital, London. By this wide dispersal of clinics and with each observer having complete independence to express his own opinion, it was hoped to advance our knowledge, and give a thorough trial to the treatment outlined in the earlier part of this paper.

Controls

In addition to the main series, the following controls were carried out:

(1) Mr. Plewes, at the Luton and Dunstable Hospital, treated twenty cases with Arachis Oil only, in exactly the same way as the benzyl salicylate mixture (B. S. Co.) series, alternate patients being taken and injected by Dr. Laughton Scott, the solution being exactly similar in appearance to the B. S. Co., and the selection being made by Mr. Plewes. The results obtained were 2 (or 10 per cent) symptom free or much improved, 16 (or 80 per cent) slightly improved or unchanged, and 2 (or 10 per cent) were worse.

(2) Dr. Cowan, in Sunderland, treated twelve cases with multiple needling to ascertain whether autohaemotherapy, or some such process, might be responsible rather than the drugs in the actual material injected. Of these twelve controls, two did not return after the first operation, two showed slight improvement after three, one was completely relieved of symptoms, two became worse, and five showed no change after five operations.

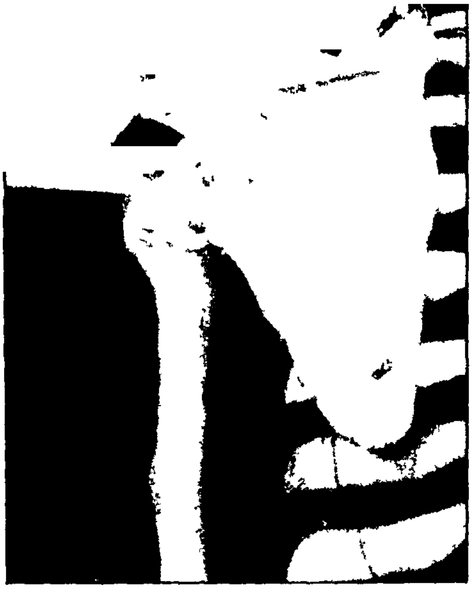

Fig 5. — Injection: Neck of the scapula

(3) My Registrar, Dr. Dobney, injected fourteen normal volunteers with the B. S. Co. solution in order to ascertain if any malaise of the type so constantly found by all the investigators was produced. In no case was this characteristic malaise produced.

(4) I personally treated thirty-four cases of a similar type with histamine ionization and deep massage; these gave the following results — 44.1 per cent symptom free or much improved, 50 per cent slightly improved or unchanged, and 5.9 per cent did not complete the treatment owing to severe general reaction. The average number of treatments in this control series

was 12.4 per patient, given three times a week, compared with 8.3 for my B. S. Co. series, given once a week It was also noticeable that the successes in the controls were largely among the cases with a short history, whereas the B. S. Co. patients were evenly spaced in this respect.

Comment

All the collaborators were unanimous on the following points:

(a) That the time taken over treatment was reduced with the B. S. Co. as compared with other forms of treatment, thus greatly lowering the time lost from work.

(b) That the treatment produced greater improvement, and ultimate relief of symptoms than other methods familiar to them, and that this improvement was maintained for more than six months (average 8.9 months).

(c) That there was a noticeable improvement in the general health of the patient in a large number of cases.

(d) That there was a close relation between successful results and injections that were given close to the bony attachments of the muscles. This is a point I would like to emphasize, as I have employed the technique described to a considerable extent myself since the completion of the investigation, and have found that my results have improved steadily as I became more experienced in its use. I think it is of interest to record that I deliberately injected some six cases in the muscle belly, and in no case did I obtain any improvement until I commenced to inject down to the bony attachments. I would therefore add as a warning to anyone embarking on this treatment, that he should follow the technique closely, and be prepared to undertake a considerable period of trial and error before passing a final judgment.

Further Investigations

So interested and impressed was I with the results obtained that I determined to make a small concentrated study of painful shoulders whose symptomatology was pain developing in the shoulder for no known reason, radiating down the upper arm, the pain being severe even at rest and increasing on movement, with marked tenderness on pressure over the neck of the scapula and/or the supra scapular notch. I have always found that this type of lesion is particularly difficult to treat with success either by physical measures or by injections of local anesthetic, almost always needing a very prolonged course of treatment, and often ending with a frozen shoulder. I thought it would be most interesting to see if this condition would respond to the technique we had used almost exclusively for low back pain. I am happy to tell you that here also I have had considerable success.

The method of injection used followed the general principles employed in the previous series, namely, down to the bony origin of the muscles in the tender areas. Figs. (4) and (5) show on the skeleton the sites of injection for supra-scapular notch area and neck of scapula, respectively. Each injection was preceded by 1-2 cc. of 1 per cent procaine hydrochloride (Novocain) to alleviate immediate pain, and was followed by 3-4 cc. of B. S. Co. if no improvement was found in six injections, treatment was abandoned, and the case considered a failure.

Comment

Injections were given at weekly intervals, without any other treatment, the results being evaluated under the same headings as for the investigation on fibrositis. These give the following results in 12 cases — 9 or 75 per cent symptom free or much improved, 3 or 25 per cent no change. The average number of treatments was 2.6. As a comparison, a series of 12 cases treated by physiotherapy needed a minimum of eleven, and a maximum of sixty treatments to produce a similar result. I regret the number of cases is small, but the condition is by no means as common as fibrositis.

I would like to make it clear that I have been dealing with the pain factor in this series. The question of restriction of movement in the affected shoulder is quite a different problem, being in the great majority of cases the result of failure to move the joint. I do not claim that this treatment will clear it up, but if it is commenced early enough it will prevent the formation of a "frozen" shoulder. Once this has occurred only prolonged physiotherapy, possibly combined with manipulation of the joint under an anaesthetic, will regain the lost movement.

This injection, however, is one that may produce severe pain for 24-48 hours afterwards. I believe this is due to stretching of muscle tissue, which in these areas has little space to expand, the prolonged pain being due to the slow absorption of the oily solution. I have encountered the same pain, but for a much shorter time, after injecting local anaesthetic to the same areas. It is also important to be certain the B. S. Co. is not injected into a blood vessel, or an oily embolus may be produced.

With regard to the pathology of this condition, it is interesting to note that biopsies taken from the muscle attachments deep to the tender areas showed aggregations of small cell infiltration, similar in type to those described in various rheumatic conditions, and the periosteum beneath was found to be markedly thickened. I will not, however, enlarge on this as further investigations are being undertaken in respect of these findings.

Sincere thanks are due to Dr. C. B. Heald, the director of our research, and to my colleagues, Mr. L. W. Plewes, and Dr. I. Cowan for permission to publish their results, also of the Dora Garrad Anderson and the Halley Stewart Trusts for their generosity in making our research possible.

Discussion

Dr. Fred B. Moor (Los Angeles): I wish to thank our British colleague for describing to us a new approach to the problem of the treatment of fibrositis, which, we must admit, is in an unsatisfactory state. This situation will continue until more is known about the pathological physiology of the condition. Until that time, our treatment is bound to be mainly empirical.

The controversy concerning the existence, the etiology, and the pathology of fibrositis was nicely stated by Cyriax[1] when he observed that its existence is affirmed by most clinicians and denied by most pathologists. Cyriax maintained that primary fibrositis was an imaginary disease and that the symptoms ascribed to it were the result of articular disorders, mainly of the spine. Fibrositis secondary to trauma and infections, however, he considered, a clinical entity. Attention has also been called by Copeman and Ackerman[2] to the relationship of the "basic fat pattern" to the distribution of gluteal and lumbar pain in cases where pain was ascribed to fibrositis. They found by actual dissections that increase in volume of fat lobules inclosed in unyielding fibrous capsules gave rise to pain. Actual herniations of fat through weak spots in the capsules were observed to occur. Surgical procedures gave relief. Nevertheless, in spite of the unsatisfactory state of our knowledge concerning the etiology of fibrositis, those of us who have to deal with the condition in patients from day to day are forced to treat it, if on a more or less empirical basis.

We are indeed indebted to Dr. Martin for this controlled clinical study on a new method of treatment of fibrositis. From a pharmacological standpoint, it is difficult to explain mode of action concerned in the local injection of his benzyl salicylate compound. The results reported are impressive: 48.3 per cent free from symptoms and 32.2 per cent much improved, a total of 78.5 per cent. I do not have immediately available any reliable figures on the results of our usual treatment of fibrositis in this country by heat, massage and exercise. It is my impression, however, that our results will approach those of Dr. Martin, although we must admit that our procedures are much more laborious and often more prolonged.

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[1] Cyriax, J. Fibrositis, Brit. Med. J. 2:251 (July) 1948.

[2] Copeman, W. S. C., and Ackerman, W. L. Edema or Herniations of Fat Lobules as a Cause of Lumbar and Gluteal "Fibrositis," Arch. Int. Med. 79:22 (Jan.) 1947.

BACKGROUND FOR AN UNDERSTANDING OF SPINE AND TRUNK FUNCTION *

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To gain comprehensive working knowledge of the functional anatomy of the vertebral column and the trunk, a brief survey of their phylogeny, aided by a review of some of the salient features in their embryology, appears essential.

Through structural adaptations, a term replete with implications, the trunk and spine of man have reached a level of organization which makes it possible for the human body to carry on under a great variety of stresses and strains in the course of an individual life span. We have gone far along this road of adjustment of the body to its environment but we are as yet not completely adapted to the upright position. This position has entailed widespread rebuilding and modification of the spinal and trunk architecture. Many of the ills that afflict the human column result either from a lack of complete adaptation to the upright position or from neglect and abuse we visit upon trunk and column by our insistence upon the conversion of our bodies into sedentary, sessile caskets in which to house our nervous systems and our digestive tracts, forgetful of the fact that nervous system and tracts to function at high levels require action as much as do trunk and spine.

The Vertebral Column

Man belongs to that vast animal assemblage in which the column forms the central longitudinal axis of the body. Preceding acquisition of a vertebral column, certain animals, probably precursors of the vertebrates developed a notochord (fig. 1), an elongate axial rod whose cells through turgor gave support, offered muscular attachment and appendicular connections for body organs and appendages. Man's own individual history repeats very briefly this notochordal phase of the past.

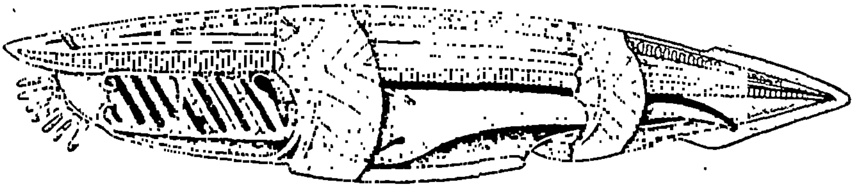

Fig. 1. —Schematic drawing of Amphioxus. The striated band extending from rostrum into the tail represents the notochord. Note the relation of the body musculature, represented in the two intact sections, to the notochord.

In early aquatic forms the notochord was replaced either by a cartilaginous or by an osseous backbone of individual vertebral elements in contrast to the single uninterrupted notochordal rod. Presumably this offered greater flexibility and strength than did the notochord. It must be remembered that the backbone with its associated musculature is the chief locomotor organ in the fish as well as in many amphibians and reptiles, and the short seg-

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* This article is based on two lectures given before the American Congress of Physical Medicine, Denver, Colorado, September 1, 1951.

† Cleveland Clinic Foundation and Western Reserve University.

mental muscles prominent in these forms can exert considerable pulls upon various segments of the column. This column did not yet possess the secondary articular facets which become a part of the backbone in the land animals; the necessary elasticity was offered at the intervertebral discs. Ribs had already become associated with the column at the fish level.

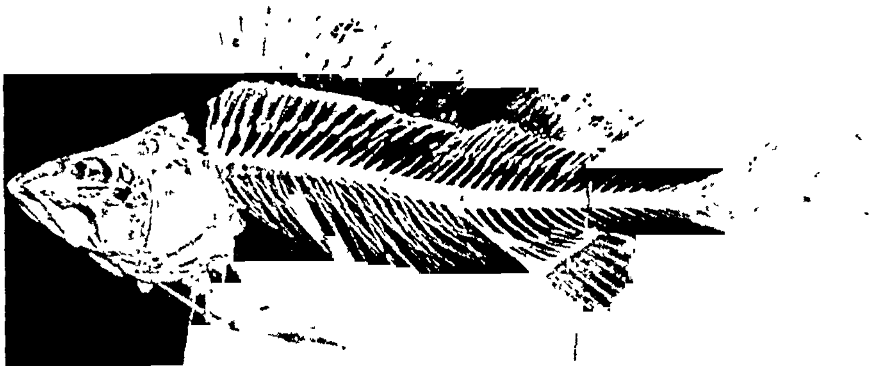

Fig. 2. — Skeleton of the bony fish. The spines extend from the centrally placed vertebral column. Locomotion is chiefly by action of muscles pulls on the column.

In the fish there is little of vertebral differentiation. When it does occur it is found first at the junction of the head and column; secondly at the sacrocaudal junction. With the changing patterns in the caudal region, modifi-

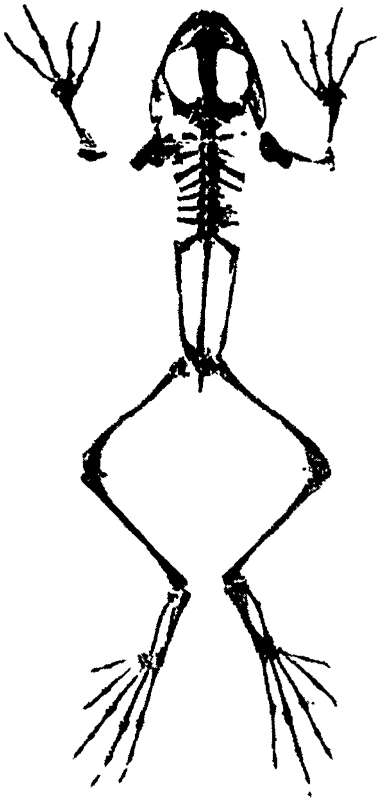

Fig. 3 — Skeleton of a frog. Emphasis is on the development of appendicular skeleton and muscles, while the column is greatly reduced and ribs are absent.

cations develop in the tail. Generally these are represented by reduction in size of the individual vertebral elements, loss of hemal arches, and always there is a failure of the neural canal to continue for any distance beyond the sacral level (fig. 2).

With the successful conquest of land by the Tetrapoda, or four footed land animals, great structural changes were demanded of the column. In the frogs for example (fig. 3) a high degree of specialization adapted the animals for jumping. In the turtles a heavy armour was imposed upon and fused with the column and the ribs, resulting in an unwieldly and inflexible covering into which head, tail and appendages might be withdrawn. The musculature associated with the spine became reduced in some of these early land forms and the appendicular skeleton and its musculature were magnified. Such mechanisms required considerable power for lifting and transporting the heavy bodies, a condition which brought in its wake larger hearts, a higher degree of vascularization and possibly changed food habits. A comparison of heart weight, amount of blood, and color of the muscle in the turtle with that of some other reptilians shows graphically the demands made by heavy armour and skeleton. In the snakes, on the other hand, because of the loss of appendages, vertebral column and ribs are the dominant skeletal parts (fig. 4).

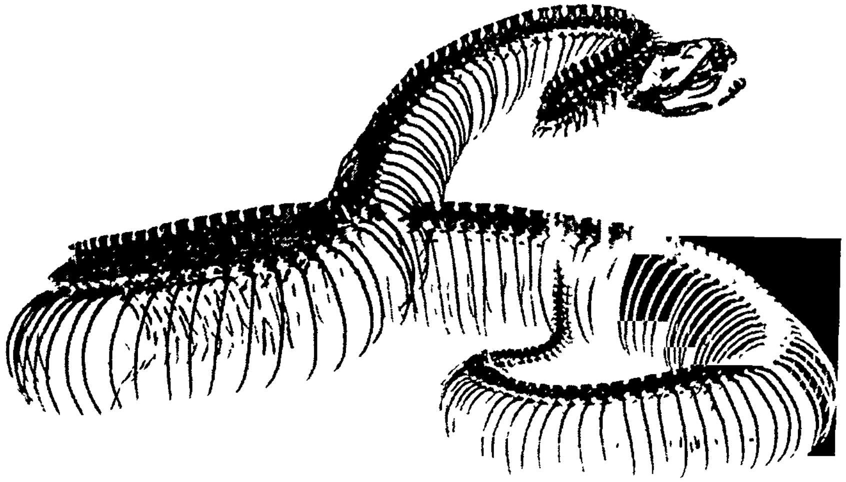

Fig. 4. — The skeleton of the snake. Loss of appendages has brought the ribs and vertebral column into prominence for locomotion. With the associated musculature the locomotor mechanism may be compared to an elongate spring in which the ribs form the hoops.

Nature ultimately devised a highly successful body form, already forecast in some of the reptiles. This type of body architecture reached its highest development in the mammals. Some anatomists explain these processes by the concept *EVOLUTION*. Others invoke the idea of *ARCHETYPES*. This latter concept implies that animal form or species, whatever its nature, strives to reach a pattern represented by an idea, or that present forms are related to basic or primitive models of the past. At best the animal can only approach this ideal. Still others dismiss the entire problem by invoking the concept of *DIRECT CREATION*. Whatever course life may have taken in the past it is impossible to ignore fundamental animal relationships and relegate them to mere resemblances. The basic features of the mammals which made their success and dominance possible are: an endoskeleton without armour, except insofar as scutes, feathers or hair might be called an armour; articulated lever systems, which may become highly specialized hind and forelimbs, an elaborately articulated vertebral column strengthened at strategic points where head, fore and hindlimbs become associated with it; the entire body weight carried some distance from the ground and more or less equitably distributed over the two pairs of limbs (fig. 5).

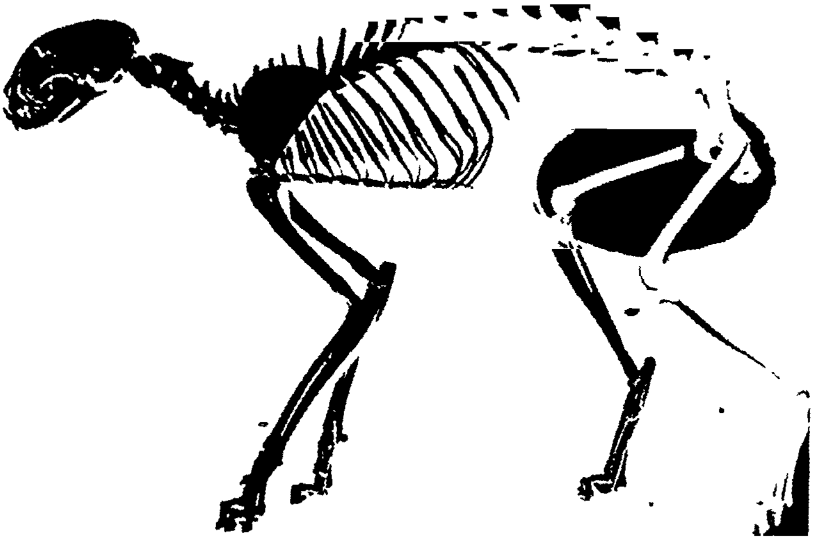

Fig 5 —The skeleton of the cat The column presents a long arch between the appendages and a shorter one from head to the middle thoracic region It is articulated at the center and at the specialized articular facets

The mammalian body became variously modified In the birds, a group quite remote from mammals, and in one small group of primates, the Hominidae, by tilting the long axis (represented by the backbone) from a horizontal to a vertical plane an upright position was achieved We do not know how

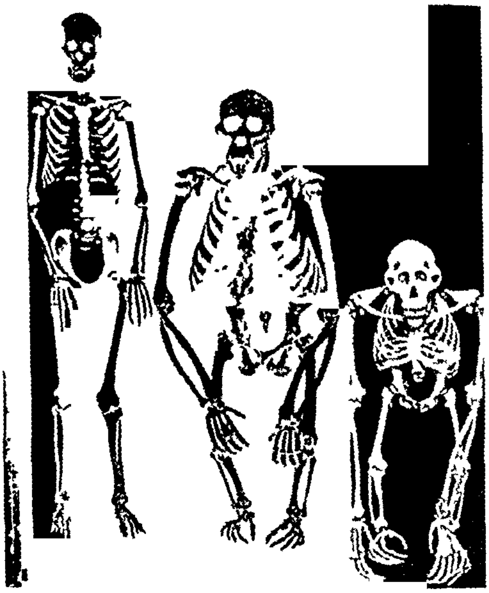

Fig 6 — Skeleton of man, gorilla and orangutan These three primate groups represent stages in development of the erect posture Notice the tilted pelves in gorilla and orangutan the relative length of arms and legs and the differences in the thoracic baskets when compared to man

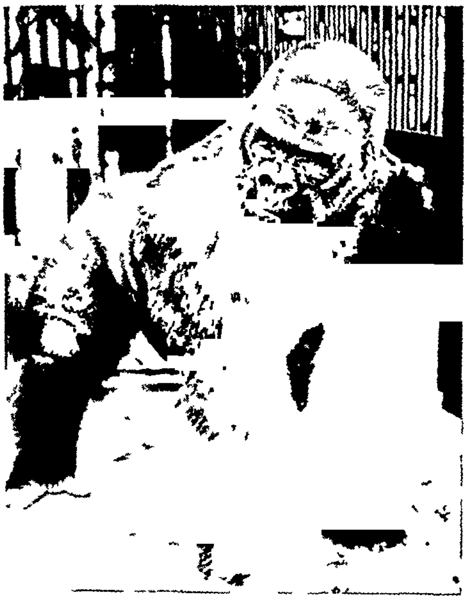

Fig 7 —The gorilla, Bushman, former inhabitant of the Lincoln Park Zoo in Chicago Note the chest supported and elevated by the arms Compare the position of the extended head with the usual position of the human head Courtesy R Marlin Perkins, Director of the Lincoln Park Zoo, Chicago, Illinois

long it required to develop this tilted type of primate skeleton to the point where it might be considered successful. All fossil evidence indicates that man did not appear upon the scene until somewhat less than a million years ago, although the early semi-erect primates go back some 60 million years ago to the Palaeocene.

Apparently man derived from a tree dwelling ancestry. His forelimbs or arms are no longer weight bearing organs, his free hands, forward vision, lack of olfactory development, his fingernails rather than claws, the retention of a clavicle, all point to such antecedents (fig. 6). While man, in comparison with the great gorilla, may not compete with the latter in strength he has gone far beyond in the matter of upright posture and intelligence (fig. 7). In the light of this history, let us examine the human spine and trunk, reviewing first very briefly their embryology before considering the adult anatomy.

Development

A. Skeleton. — What are the skeletal-muscular relationships in the embryo and the fetus? After the segmental somites of mesodermal origin are laid down in the embryo a rapid differentiation between epimere, mesomere and hypomere takes place. The hypomere becomes associated with the endodermal lining of the gut and with the body wall by a tangential split in its original single layer. The splanchnic layer surrounds the gut and forms its smooth musculature; the somatic layer forms the peritoneum and pleura. The space between the two layers is the coelom. The mesomere moves medially and becomes active in the formation of the kidney. The epimere segregates three types of cells: (1) the dermatome, responsible for the deep dermal layer of the skin; (2) the sclerotome, responsible for the development of the skeletal elements of the vertebral column and skeleton; and (3) the myotome from which will develop and differentiate the musculature of the back, abdomen and appendages (fig. 8).

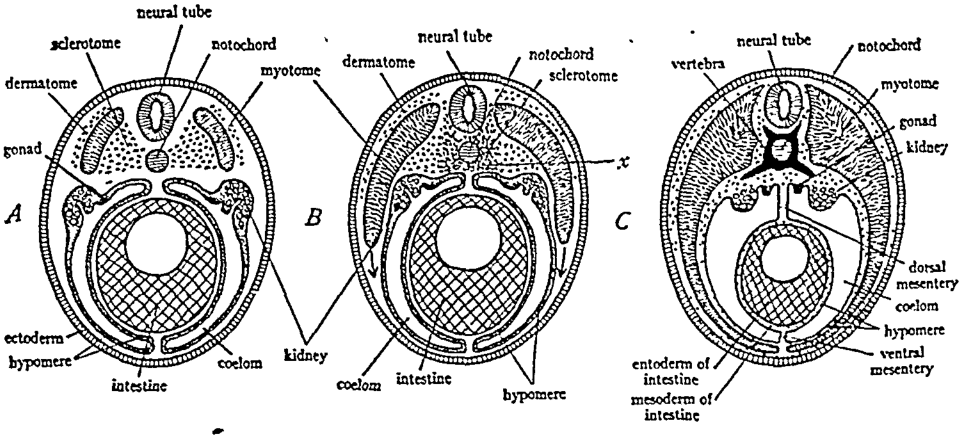

Fig. 8. — Three stages in the development of the vertebrate musculature and skeleton. The body muscles are derived largely from the myotomes, the vertebral column from the sclerotomes, and the deep layer of the skin from the dermatomes. Courtesy of The University of Chicago Press, Chicago, Illinois.

The blastemal vertebrae grow from three centers of chondrification, one for the neural process, one for the costal process and one for the vertebral body. Cartilages lengthen at the site and at the expense of the intervertebral discs and fuse briefly to form a continuous cartilaginous rod. With the constriction of the region between individual vertebral chondrifications the true interveterbral discs are differentiated: at their periphery appears the annulus fibrosis; the notochord loses its continuity; the cells of the original notochord become clumped in the vicinity of the flattening discs and give origin to the nucleus pulposus. The notochordal cells lose also their cell membranes and form a syncytium similar to mesenchyme, with mucin formed about what remains of the former cells. The cartilages of the bodies of the vertebrae gradually ossify as the vascular tissue continues to invade the region. With these changes, transverse, neural, articular and laminar processes appear upon each vertebra plus a separate center for each rib.

With the establishment of these foundations the remainder of the story of the development of the column becomes one of differentiation of secondary supporting elements, namely, the ligamentous bands that hold the segments together.

B. Muscles. — Early embryologists were troubled with the question of neurogenic or myogenic initiation of muscle development. The brilliant early work of Harrison (1904) showed conclusively that removal of the frog spinal cord before histological muscle differentiation had begun did not prevent differentiation of muscle substance. Even individual muscles would differentiate from the myotomes in the absence of the nerves normally associated with them. It became obvious that muscle could develop independently of nerves. Nerves ordinarily serve as important keys to muscle origins and differentiation from certain specific myotome groups.

In the embryonic origin of muscles a characteristic of the myloblast antecedents consists of the small granules that give rise to muscle fibrillae. These fibrillae eventually fuse or become most intimately associated into columns. Subsequently they exhibit the beginnings of striation first indicated by differences of staining ability of the parts of the fibrillae. Longitudinal splitting of the fibrillae and their orderly arrangements into columns, causing similar light and/or dark striations to become arranged in the same planes, is virtually complete at the ten weeks stage in the human embryo.

It should be mentioned that a period of degeneration and reorganization occurs between the appearance of the fibrillae and the development of the definitive muscle fibers. During this phase new myoblasts arise only from existing ones, a process which appears complete in the 130-170 mm. human embryo. Following this the muscles increase in volume only by enlargement of individual fibers. The segmental division of the mesoderm has been observed as early as the 1.17 mm. stage and progresses in a cranial-caudal direction. Subsequently the segmentation continues and includes also a dorsoventral sequence.

With the differentiation of myotome, medial and lateral myotomic lamellae join loosely and migrate ventrally. They elongate into spindle shaped cells for the width of each myotome and eventually form the muscle cells. The deep back, trunk and neck muscles are formed by fusion and splitting of the myotomes. With disappearance of the myosepta they lose their segmental character. The deepest muscles on the other hand in direct contact with the vertebral column, i. e., multifidus, interspinous, intertransverse, levators costarum, retain some of their segmental characteristic.

With the downward growth of the thoracic myotomes the thoracoabdominal muscles become differentiated in the ventral myotomic extensions. The myotomes are interrupted by the ribs in the thoracic region and meet and fuse ventrally to the rib level. The ventral line of fusion of the left and right sheets marks the site of the future rectus abdominis muscle on each side of the mid-ventral line. Longitudinal splitting of the ventral muscle column differentiates these muscles from the ventro-lateral mass. The external and internal abdominal oblique muscles arise from tangential splitting further laterally in the myotomic sheet, and an additional separation of the internal sheet gives rise to the transverse abdominal muscle as the innermost layer. The internal and external intercostal muscles represent differentiations resulting from the tangential splitting that gives rise to the external and internal oblique muscles in the abdomen. Further dorsally, division of the sheet gives rise to the serratus posterior superior and inferior muscles. Subvertebral muscles arise from the development and subsequent fusion of myotomic elements associated with the ventral surfaces of the vertebral bodies.

The foregoing, in brief, deals with the skeletal and muscular elements with which we are here concerned. Their development may be summarized briefly:

(1) Skeletal and muscular elements arise from the epimere of mesodermal derivation.
(2) The sclerotomes arising from the epimere give rise to the skeletal elements which surround and replace the notochord except for the nucleus pulposus retained in the intervertebral discs.
(3) The myotomes give rise to the back muscles, and their ventral extensions are transformed into the intercostal and abdominal muscles.
(4) Subvertebral muscles arise from myotomic elements associated with ventral portions of the vertebral bodies.
(5) The original segmental pattern becomes largely obscured or lost except in the thoracic region and in the deep, short muscles of the back.

How may we summarize the functional aspects of the vertebral column in man?

We may consider it a flexible mast or upright beam, which on occasion takes on the aspect of an arch. This flexible beam is activated by a series of guy ropes, muscles and ligaments, under dynamic control. Variations in tensions produce changes in position of this mast or boom and of the associated body parts. Proprioceptive impulses, in the absence of definite conscious cerebral commands, maintain the balance of trunk and column by excitation of the proper motor centers.

Design and structure of the column implies that weight bearing is its central function both directly and through the extremities. Second it is associated with locomotion, a function derived from its lever-like composition. Third, it protects vital areas, always an integral part of its design.

The back is extended by the epaxial muscles acting jointly; it is flexed by the abdominal muscles, chiefly the rectus abdominis, and by gravity. It is swayed from side to side or rotated by the long and short back muscles acting unilaterally.

Articulations of Vertebral Column and Trunk

The articulations of the vertebral bodies are amphiarthroses, which means that they are only slightly movable. Extensive range of movement, however, may be achieved when all of the joints are involved. The vertebral body articulations are held in place by: (1) The anterior longitudinal ligament; (2) the posterior longitudinal ligament, and (3) the intervertebral fibrocartilages. In addition to amphiarthroses at the vertebral body articulations, there are true arthrodia or gliding joints between the articular processes of the vertebrae. These are enclosed by capsules and lined with synovial membranes. A third series of attachments holding the vertebrae in place are associated with the vertebral arches and include: Ligamenta flava, supraspinal ligaments, ligamentum nuchae, interspinal and transverse ligaments (fig. 9).

Group I. Anterior and Posterior Longitudinal Ligaments and Fibrocartilages.

The anterior longitudinal ligament is a strong, flat fiber band extending along the anterior border of the vertebral bodies. It is broader below and thickest in the thoracic regions, with a further thickening at the concavities of the bodies of the vertebrae.

The posterior longitudinal ligament lies within the vertebral canal and parallel with the anterior ligament but along the posterior borders of the vertebral bodies. It is narrower below than above, and like the anterior it is

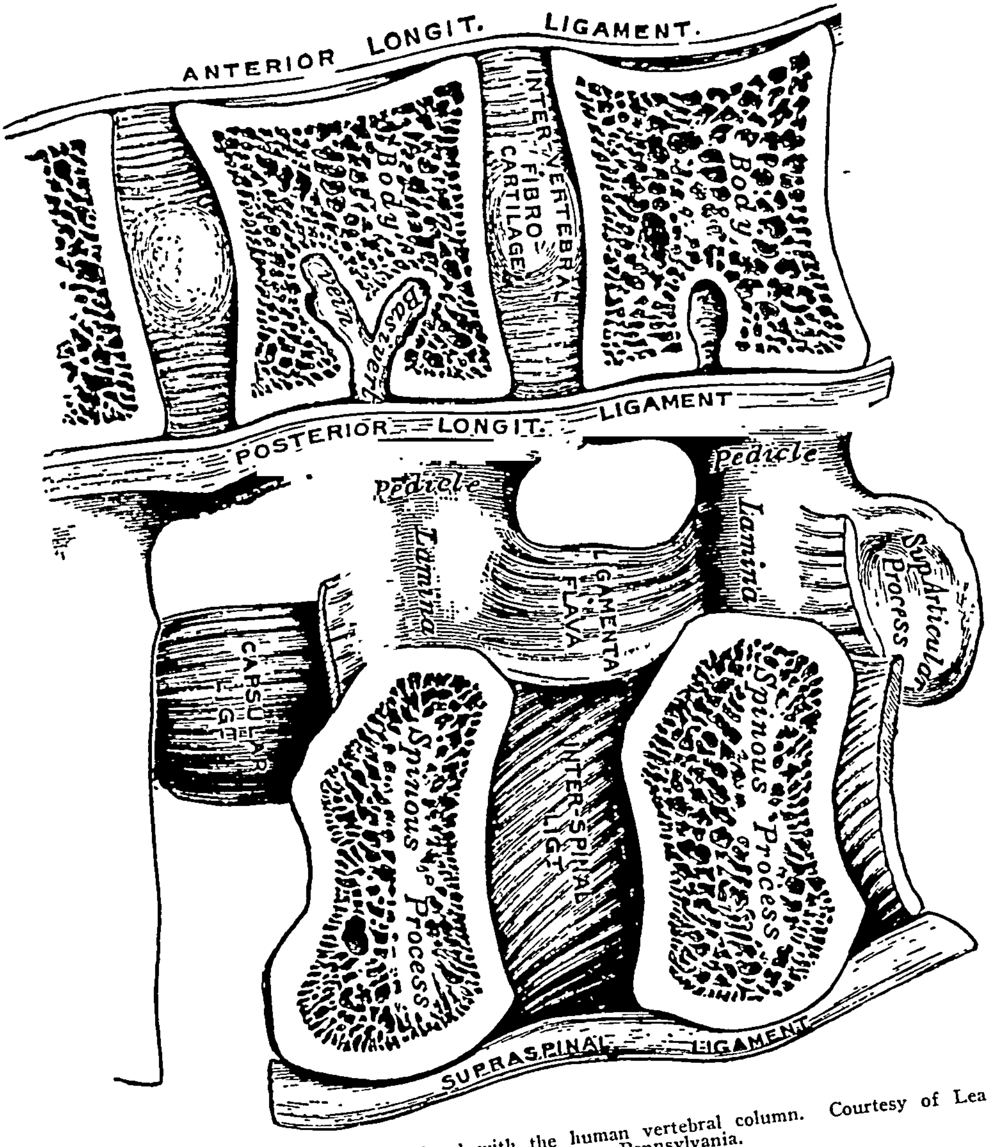

Fig. 9. — The ligaments associated with the human vertebral column. Courtesy of Lea and Febiger, Philadelphia, Pennsylvania.

thickest in the thoracic region. Opposite the intervertebral discs it spreads out to form dentate extensions about the intervertebral foramina.

The intervertebral fibrocartilages conform in shape to the vertebral bodies. In the cervical and lumbar region they are thicker in front than behind. They constitute about one-fourth of the length of the vertebral column in these regions.

The fibrocartilages are attached to the bodies of the vertebrae by thin layers of hyaline cartilage and to the anterior and posterior longitudinal ligaments. In the thoracic regions they are joined to the heads of the ribs at the demifacets by interarticular ligaments.

Group II. Ligaments of the Vertebral Arches.

These ligaments as well as those of the articular capsules are discrete bands uniting each vertebrae with its nearest neighbor above and below.

The ligamenta flava join the lamina of adjacent vertebrae. They are composed of yellow elastic tissue, and their elasticity preserves the upright position, aiding the spine returning to this posture after flexion.

The supraspinal ligament, a strong continuous cord, binds the apices of the spinous processes from the sacrum to the seventh cervical vertebra. Between the spines it is continuous with the interspinal ligaments, while from the seventh cervical vertebra upward to the external occipital protuberance and the median nuchal line the supraspinal continues as the ligamentum nuchae. It is of lesser development in man than in animals in which the head is carried horizontally.

Small, intertransverse ligaments complete the series of attachments, in this instance between the transverse process of the vertebrae. These ligaments play varying roles in the movements of the back. Thus in back flexion the anterior longitudinal ligament relaxes, and pressure is placed on the front of the fibrocartilages; the posterior longitudinal ligament, ligamenta flava, interspinal and supraspinal ligaments and the posterior portion of the intervertebral discs are stretched. Inferior articular facets move upward against the surfaces of the superior. In extension, the tensions on the back ligaments are reversed. Movements permitted in the column are forward flexion, backward extension, lateral flexion and rotation.

The degree of movement is greater in the neck than elsewhere. In the thorax it is limited because of the lower ratio of discs size to vertical bodies, presence of sloping spines, ribs and sternum. In the lumbar region while the discs are thick, the vertically set articular processes restrict rotation although so-called pure rotation of the lumbar vertebrae does occur. Anteroposterior and lateral movements are relatively free in the region.

Blood Supply and Innervation of Column and Trunk

A. Arterial Circulation. — The arterial supply to the column and the trunk is derived from the segmental aortic branches in the thoracic and lumbar regions and from spinal branches of the vertebral arteries in the cervical region. In the thorax, anastomoses between the segmental (intercostal) arteries and the internal mammary arteries and between the latter and the inferior epigastric artery supply the trunk. In the cervical region, muscular branches of the vertebral artery form anastomoses in the posterior surfaces of the bodies of the vertebrae. In the lumbar region, the segmental arteries are in series with the intercostals. They run laterally into the abdominal wall and form anastomoses with the lower intercostal, subcostal, iliolumbar, deep circumflex and inferior epigastric arteries. Their posterior rami supply the muscles and the skin of the back. Spinal branches enter the vertebral canal and, like the spinal branches of the intercostals, distribute themselves to the spinal cord and its membranes. The musculature of this region is supplied by small muscular branches from the lumbar arteries as well as from their posterior rami.

B. Venous Circulation. — The return circulation from the trunk and the spine is accomplished largely by venae comites, with exception of those draining the immediately surrounding muscles. Two intricate plexuses, an external, superficial to the vertebral bodies and spines, and an internal, lining the vertebral canal, extend along the spine with continuous anastomoses between the two. The external is best developed in the cervical region, where its posterior division makes further anastomoses with vertebra, occipital and deep cervical veins.

The internal vertebral plexuses arrange themselves roughly into two anterior and two posterior longitudinal veins. They communicate through venous rings (retia venosa vertebrarum) as well as with the vertebral veins, occipital sinus, basilar plexus, and the condyloid emissary vein in the skull. Intervertebral veins accompany the spinal nerves through intervertebral foramina and drain blood from the cord and the internal and external plexuses and into the vertebral, intercostal, lumbar and lateral sacral veins. The orifices of these intervertebral veins are supplied with valves.

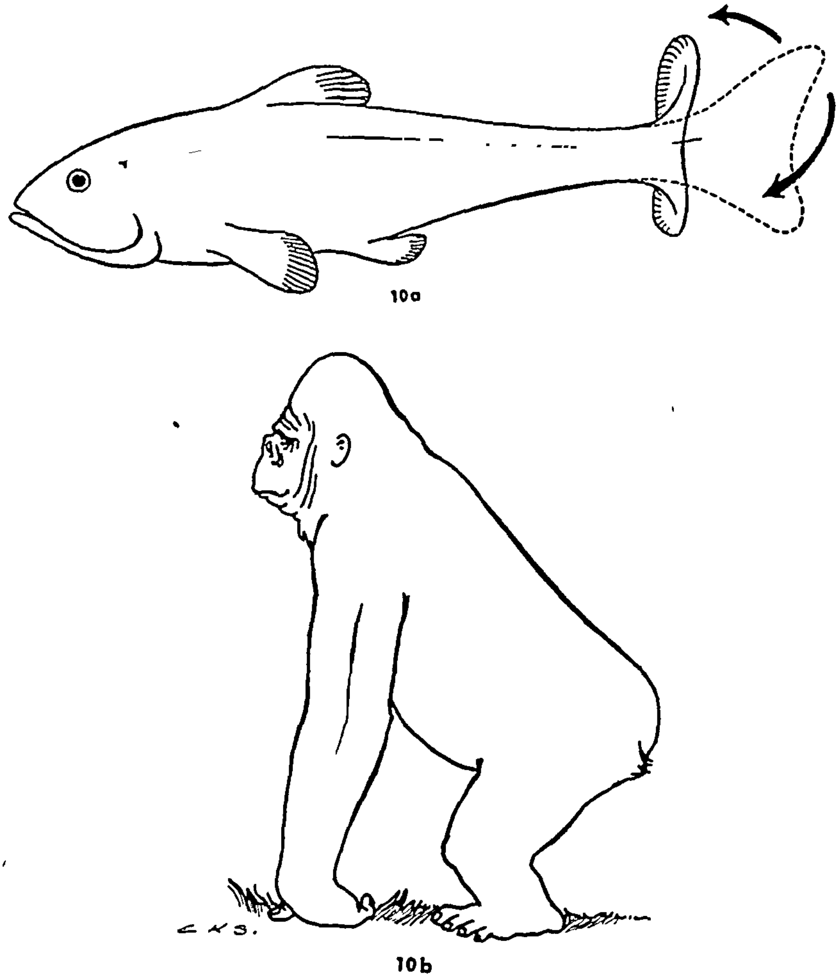

Fig. 10. — (a) Schematic drawing of a fish emphasizes the significance of the spinal column in locomotion. (b) The ape shows the tilted pelvis, reduced lumbar curve, erect head, and the role of the arms and of gravity in elevating the thorax.

These are the skeletal, muscular, supporting elements, and vascular channels that constitute the trunk and the column. It must not be assumed, however, that these parts considered as static elements include all that constitutes the living trunk and column. The living human system is a dynamic system built for action. It represents the response of man and his antecedents to the environment and its vagaries; a response reflected in untold minor and a large number of major structural adaptations.

We call the adaptations functional; they permit a high degree of freedom, a wide range of activity, the end result of which is an increased assurance for the continued maintenance and existence of the body. With advancing age and neglect the activities become increasingly restricted to such an extent that sooner or later some vital part of the mechanism breaks down and the dynamic nature of the organism is superseded by the dead structure, which after a brief period of decay is further reduced to a more probable state in which the building stones are separated into stable compounds and even into elements. Given the opportunity they again find their place in a living body, which may, however, be far below the human in level of organization. Repeated cycles of birth, growth and decay of living stuff may through the machinations of chance elevate such elements to human levels.

This description has not concerned itself with a detailed account of the muscle action of spine or trunk. For such an account the anatomy texts offer a wealth of detail that need not be duplicated here.

The survey of the changing functions and modified relationships in the preceding pages are designed to offer a broader outlook upon the two body parts with which we are here concerned. To those working with the human body it becomes a never ceasing source of deep interest. Knowledge of its background, of its similarity to other body types confronted with similar problems of body support and function, must shed light upon the factors of its maintenance in health and its restoration after disease or injury.

In conclusion the suggestion is offered that man might well imitate the fish in the maintenance of the spine; for the fish, whose locomotor system is the spine and its associated muscles, keeps these parts constantly active (fig. 10a). For the trunk, man might well look to the ape which maintains a tilted pelvis, a reduced lumbar curve, and a well balanced thorax and adducted scapulae (fig. 10b).

Abstract

Comparisons are offered between the spine and trunk of lower vertebrates and man. The embryonic development of vertebral column and the back musculature is briefly summarized. A description of the ligaments associated with the spine and the vascular supply associated with it is included in the account.

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ARCHIVES of PHYSICAL MEDICINE

OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL MEDICINE

.˙. EDITORIAL .˙.

ANCILLARY PERSONNEL IN THE FIELD OF PHYSICAL MEDICINE AND REHABILITATION

During World War II it early became apparent that the number and capacity of the schools of physical therapy could not be increased sufficiently to supply the number of trained physical therapists necessary to rehabilitate adequately the wounded and ill resulting from war. The number needed for this purpose was in addition to the number necessary for care of the civilian population. Also, following the war, great impetus was given to rehabilitation and reconditioning of Air Force personnel by the air corps and of civilian personnel on the recommendations of the Baruch Committee.

The development of new concepts of rehabilitation and the lack of knowledge of the standardized training of the physical therapist and the occupational therapist logically led to the use of people trained in physical education and to a lesser degree people trained in manual arts as substitutes for the approved groups of therapists. These people working with young patients in the army assisted in promoting the newer concept of reconditioning and rehabilitation and often achieved results rather rapidly. These workers were intelligent young men with good education and great enthusiasm. What was accomplished in a broad sense was new, although some of the concepts of rehabilitation were not new. The same basic principles developed by a few physiatrists were put into action but until the war the efforts of these physiatrists had been like a "voice crying in the wilderness."

Following the war there was a clamor by the graduates in physical education working in the army to be accepted in civilian hospitals. A few physical educators worked diligently to establish schools for training in this unnamed technical specialty. These people had had prerequisite training for physical therapy and did a good job under the circumstances through knowledge gained over several years of experience. The fact that good work was done resulted in the forgetting of many basic factors that are essential to standardized training of such therapists in peacetime. These physical educators worked later with psychiatric patients, using the skills for which they were trained. This circumstance likewise led to the belief that they were sufficiently trained in basic medical sciences to be qualified as ancillary aides.

About 1946, some 500 of the physical educators were accepted into the Veterans Administration. A job analysis was done and the United States Civil Service Commission set up requirements for what is known as an "exercise therapist." The exercise therapist was assigned the duties of giving practically all therapeutic exercise except passive and active assistive exercise which was delegated to the physical therapist.

When physical educators were first used, it was implied that they should give group exercise, recreation and reconditioning exercise for uninvolved parts. Treatment of disease entities was to be done by the physical therapist. However, in a short time this plan was changed both in the Army and in the Veterans Administration. The physical educator soon began doing practically all routines of functional analysis, testing of muscle strength, re-education, hydrogymnastics and gait training. Even fitting of braces was being done by the so-called corrective therapist. Through the years the corrective therapist, the teachers of physical education and some physicians became very enthusiastic over the results obtained by this group in the armed services and Veterans Administration. There seemed to be the impression, partly erroneous, that the physical educators had some unusual qualification for doing physical rehabilitation that no other technical person had.

This enthusiasm, zealousness and aggression and the need for more trained persons influenced advisors of this group to bring pressure on proper authorities to provide official recognition of "corrective therapists" or "exercise therapists" as a new ancillary group in medicine.

The use of the physical educator in psychiatric hospitals also gave further impetus to the growth of other types of ancillary personnel in the field of medicine in addition to physical educators. Several groups sprang up as "adjunctive therapists" in the Veterans Administration. The teacher became an "educational therapist," librarians became "bibliotherapists" and manual arts teachers became "manual arts therapists." The musicians became "music therapists" and the vocational guidance people were considered as working on a therapist's level. The psychologist spoke of therapy, the social worker became "social case work therapist" and the beautician apparently began to think of himself or herself as a "cosmetotherapist."

There is not space to discuss all the groups, nor sufficient information available to be sure of what the educational backgrounds and duties of the various therapists are. The requirement for membership in the associations of the various fields of "therapy" other than corrective therapy seems to be a degree or experience in some allied field. The so-called therapy these various groups administer seems so vague that one cannot obtain a clear picture of the function of each group.

The physical educator and perhaps the manual arts teacher are sufficiently close in their preliminary training to comparable groups of standardized technical workers (physical therapists and occupational therapists) so that they can be compared more easily.

One cannot agree that the qualifications of the physical therapist and the "corrective therapist" are essentially the same, as stated in an editorial in the ARCHIVES in February, 1952. One of the prerequisites for training of physical therapists is that they be graduates in physical education, but thereafter they must take at least a year's training in an approved school of physical therapy in which they are given an intensive course in the basic sciences and techniques of physical therapy. These techniques include those of rehabilitation, certainly as far as therapeutic exercise is concerned. Physical therapists are trained in handling the sick and disabled under medical supervision.

The training of the physical educator is in relation to health education and the training of normal people. Until recently there was, in the courses in physical education, little basic science as applied to medicine and with a few exceptions little training in medically supervised clinical management of the handicapped and ill person. There is apparently little or no standardization of schools of physical education except by state commissioners of education. There are more than 300 schools of physical education, large and small, which graduate great numbers of students each year. It is apparent that many of these schools do not have clinical material and cannot obtain the extensive medical supervision required to train ancillary medical personnel.

The educational requirements of the manual arts therapist does not seem to be even as well defined as that of the corrective therapist; however, if academic degrees are required it can be seen that the use of their skills cannot help but overlap with those of the occupational therapist. They may have the prerequisite training of an occupational therapist, but they have not had basic and clinical training in the care of the sick except through experience.

If one analyzes what basic training should be given to these four groups it becomes quite obvious that, if they are to work in the field of physical rehabilitation, it should be much the same. To attempt to approve schools of physical education, and manual arts courses, as schools for additional ancillary aides would indeed be difficult. How can 300 schools of physical education be inspected? Why duplicate training when schools of physical therapy and occupational therapy are already in existence in medical centers where they must be established? To accept schools of physical education as suitable institutions for training therapists at present would greatly reduce educational standards. The obligation of the physician to see that his ancillary personnel are properly trained is one which is most important, because it is he who must maintain standards in order to fulfill his duty to the patient. He must look to the patient's welfare and protection. He must become aware of that which trained persons must know basically, and he must know what that person's educational background is and whether he will be equipped educationally to care for his patients competently and ethically.

It is a rather grave question as to whether new avenues of approval should be opened so that anyone who comes in contact with a patient during his convalescence should be qualified as a "therapist." Definite graded standards for all groups are being considered. These standards would make it imperative that all groups have courses varying from limited indoctrinational courses in the field of medicine to courses which provide definite, limited, formal, qualified training in order to be approved.

No doubt all groups now considered as "adjunctive therapists" in the Veterans Administration may find a place in medicine, but whether they all need to be certified as therapists is another question. Do they need to be called something different, and approved as such, if they are really just teachers, physical educators, musicians or psychologists?

The answer to the problem does not seem to be in a sudden attempt to register these groups immediately as therapists but lies in further careful study of the problem. The answer may be reached by development of graded positioning of various educational qualifications, indoctrination and formal courses of training according to the skill needed. There should not be approval of new groups which are so closely allied to existing approved groups that their work markedly overlaps that of the approved groups. It seems logical to conclude that there should be standardized basic training for those groups of workers who actually treat the ill and physically handicapped, with branching off for specialization in the various ancillary fields in physical rehabilitation, psychiatry and the like according to the demands believed needed by the physicians specializing in those fields. To continue to accept vague educational standards which were necessarily acceptable during the stresses of war may greatly reduce educational standards of peacetime. The obligation of the physician to see that his ancillary personnel are properly trained is one which is directly related to the welfare of the patient. It is the physician who must be aware of the basic knowledge of the aide, and it is the physician who is competent to determine whether that education is such as to equip his aide to care for patients under his medical supervision safely, competently and ethically.

MEDICAL NEWS

Members are invited to send to this office items of news of general interest, for example, those relating to society activities, new hospitals, education, etc. Programs should be received at least three weeks before the date of meeting.

Report American Registry of Physical Therapists

Period Jan. 1 to Dec. 31, 1951

Number of registrations completed	481
Number examinations conducted	579
Number retake examinations conducted	37

Certificates Issued According to School of Graduation

Name of School	Number of Graduates Registered
Albany Hospital, Albany, N. Y.	3
Boston University College of Physical Education for Women, Sargent College, Cambridge, Mass.	26
Bouve-Boston School of Physical Education, Boston, Mass.	14
University of California School of Medicine, San Francisco	16
Childrens Hospital, Los Angeles	10
Cleveland Clinic Hospital, Cleveland	6
College of Medical Evangelists, Los Angeles	13
Columbia University, College of Physicians and Surgeons, New York City	22
Duke University, Durham, N. C.	23
Hermann Hospital, Houston, Texas	8
State University of Iowa College of Medicine, Iowa City	17
University of Kansas Medical Center, Kansas City, Kans.	18
Mayo Clinic, Rochester, Minn.	29
University of Minnesota, Minneapolis	9
New York University, School of Education, New York City	24
Northwestern University Medical School, Chicago	14
Division of Physical Therapy of the School of Auxiliary Medical Services of the University of Pennsylvania, Philadelphia	1
St. Louis University, Division of Health and Hospital Services, St. Louis	18
Simmons College, Boston	12
University of Southern California, Los Angeles	20
Stanford University, Stanford University, Calif	35
University of Texas School of Medicine, Galveston	6
Washington University School of Medicine, St. Louis	11
D. T. Watson School of Physical Therapy, Leetsdale, Pa.	59
University of Wisconsin Medical School, Madison	26
Permanente School of Physical Therapy, Oakland, Calif.	21
Medical Department — U. S. Army —	
Fitzsimons Army Hospital, Denver	13
Walter Reed Army Hospital, Washington, D. C.	7
	481

Program to Help Disabled

A program of medical care, physical and social readjustment and job placement of the handicapped has been undertaken by Columbia University, Presbyterian Hospital, and the Institute for the Crippled and Disabled. Columbia has established a department of physical medicine and rehabilitation and Presbyterian Hospital has set up an independent physical medicine and rehabilitation service. The aims are to strengthen the rehabilitation and reeducation programs of the hospital and institute; to give the university divisions opportunities for the study and improvement of methods of rehabilitation; to provide a joint research and instructional program in rehabilitation; to effect a joint program providing all professional services in proper continuity and to provide for reciprocal interchange of facilities and services.

Newly Registered Therapists

May 9, 1952

Grigsby, John Booker, Apt. 8, Craig Ct., Franklin, Tenn.

Homyak, George, 201 W. Ridge St., Nesquehoning, Pa.

Hunt, Wilbur E., Rt. 2, Pineville, La.

Murray, Stanford E., 366 Hazelwood Terr., Rochester 9, N. Y.

Petitt, Floyd L., Box 472, Chautauqua, N. Y.

Sutcliffe, Esther B., 1530 E. 14th St., Tulsa 14, Okla.

May 15, 1952

Purnell, William Edward, 1130 Mt. Ephraim Ave., Camden, N. J.

May 19, 1952

Jeffery, Shirley Mae, 221 Erie St., Edinboro, Pa.

Tichenor, Mary C., 837 Tennessee St., Lawrence, Kan.

Newly Registered Therapists

June 6, 1952

Colligan, Jean Marie, 23 Northend Ave., Salem, Mass.

Cuetara, Nancy Ristine, 100 Memorial Dr., Cambridge, Mass.

Edmonds, Arreta Irene, 9 Third St., Pittsfield, Mass.

Fallon (Mary), Patricia, 34 Sackville St., Charleston 29, Mass.

Fitzpatrick, Elizabeth Ann, 286 Moreland St., Worcester 5, Mass.

Fuhr, Myra Ann, 216 Dartmouth Ave., Buffalo 15, N. Y.

Henderson, Jean Marie, 200 Edgeworth Rd., North Quincy 71, Mass.

Hunter, Marilyn Fitzgerald, 169 Islington Rd., Auburndale 66, Mass.

Kelly, Eleanor Mary, 96 Wentworth Ave., Lowell, Mass.

Mann, Sara Jane, 117 Youle St., Melrose, Mass.

Martin, Ruth Elizabeth, 285 Payson Rd., Belmont, Mass.

Philp, Jeanne Lois, 14 Royall St., Canton, Mass.

Singer, Janet Sylvia, 463 Delaware Ave., Albany, N. Y.

Singer, Norma Belle, 438 Manning Blvd., Albany, N. Y.

Accepted Devices

Sanborn Electrophrenic Respirator. — Manufactured by Sanborn Company, 39 Osborn St., Cambridge 39, Mass., device generates electric currents designed to stimulate the phrenic nerves, inducing contractions of the diaphragm in apneic patients. The Council on Physical Medicine and Rehabilitation voted to include the apparatus in its accepted list with the understanding that it should not be used for first aid by lay groups (such as fire departments), nor for prolonged care of apneic patients. It is a satisfactory means of resuscitation when used under direct supervision of a physician.

Ultrafaradic M-4 Impulse Generator. — Manufactured by The Ultrafaradic Corporation, 212 Cortland Ave., Winter Park, Fla., electrical device is designed to elicit muscular contractions by controlled shocks. The Council on Physical Medicine and Rehabilitation voted to include the apparatus in its accepted list.

Blood Irradiation Society Meeting

At the June meeting of The American Blood Irradiation Society, Dr. O. L. Huddleston presented a paper entitled "Clinical Observations."

Samuel J. Harris

It is with regret we announce the death of Dr. Samuel J. Harris, Boston, Mass. Dr. Harris had been a Congress member for many, many years.

Personals

Dr. **Louis B. Newman**, Hines, Illinois, participated as a panel member in a symposium on "The Rehabilitation of the Cardiac Patient," at the meeting of the A. M. A., in Chicago, June 12.

Dr. **Howard A. Rusk**, New York, N. Y., addressed the annual meeting of the Health Division of the Welfare Council of Metropolitan Chicago on June 9.

Dr. **Donald A. Covalt**, New York, N. Y., was one of the discussors on the subject of "Chronic Disease" at the annual health conference of the New York State Department of Health, Lake Placid.

During the month of June, Walter Reed Army Hospital, Washington, D. C., conducted special teaching clinics, conferences and seminars, etc. Lt. Col. **John H. Kuitert** was in charge of the Neuromyology and Poliomyelitis Clinics.

Chicago Society Officers for 1953

At the May, 1952 meeting of the Chicago Society of Physical Medicine and Rehabilitation, the following officers were elected: Arthur A. Rodriquez, President; Milton G. Schmitt, Vice-President; I. F. Hummon, Financial Secretary-Treasurer. The Board of Trustees consists of Doctors Gusta Davidsohn, H. Worley Kendell, and Louis Gereb. The following committees were appointed:

Program Committee: Milton G. Schmitt, Chairman; F. A. Hellebrandt; C. O. Molander.

Membership Committee: Gusta Davidsohn, Chairman; Y. T. Oester; George Barnett.

Medical Economics: Joseph L. Koczur; Irvin Hummon; Y. T. Oester.

Publicity and Education: Joseph L. Koczur; Ray Piaskoski; Maxwell Flank.

New Jersey Society Meeting

The New Jersey Society of Physical Medicine and Rehabilitation met in Atlantic City on May 20 and elected the following officers: Thomas P. McConaghy, President; Bertram M. Bernstein, Treasurer, and Bror S. Troedsson, Secretary.

It was decided that the Society should try to bring physical medicine and rehabilitation treatments into the Medical-Surgical plan of New Jersey. A resolution was passed to the effect that the Society should cooperate with the technicians' society to get a law passed insuring licensing and more stringent educational requirements than are presently required by New Jersey statutes.

Postgraduate Seminar

Two hours will be devoted to physical medicine at the Postgraduate Seminar for the Academy of General Practice, Medical College of Alabama, on August 21, 1952.

Dr. James R. Garber has made this possible through his unselfish, generous and kind cooperation. Dr. Garber, incidentally, instituted the first session on physical medicine and rehabilitation.

BOOK REVIEWS

The reviews here published have been prepared by competent authorities and do not represent the opinions of the American Congress of Physical Medicine.

THERAPY OF DERMATOLOGIC DISORDERS INCLUDING A GUIDE TO DIAGNOSIS AND A DERMATOLOGIC PHARMACOPEIA. By *Samuel M. Peck,* B.S., M.D., Dermatologist to Mount Sinai Hospital, New York City, and *George Klem,* M.D., Associate Visiting Dermatologist, Morrisania City Hospital, New York City. Cloth. Price, $6.50. Pp. 383, with 4 illustrations. Lea & Febiger, 600 S. Washington Sq., Philadelphia 6, 1951.

General physicians and students will find this compact volume a useful desk reference, especially so if an hour or two is devoted to a study of the material in Part I on pages 7 to 31. This section includes a topographical and differential diagnosis of 52 dermatoses in a cross reference diagrammatic and tabular form without confusing details. Part II describes general principles as well as specific therapy from the standpoint of management of internal diseases with skin manifestations, and the pure dermatoses and their treatment according to presenting symptoms. About 235 conditions are briefly described and grouped according to etiology, unknown etiology and clinical similarity. The section on contact dermatitis seems to have been written especially for the benefit of the industrial physician; whereas it should have been enlarged to include a list of external irritants and their most frequent sites of contact thus serving as a guide to any physician in the "detective work" so necessary in the recognition of the external irritant. Dermatopathology is omitted but has no place in a volume of this type. The resumé of standard internal and topical therapy, including the newer antibiotics, chemotherapeutic drugs and hormones, together with corticotropin and cortisone, is up to date. The authors frankly state that, in the main, the therapeutic agents which they themselves prefer are set forth in the paragraphs on treatment of the diseases. This accounts for the detailed methods for use of moccasin venom in the purpuras. Of interest to all physicians, especially the geriologists, are the sections on nevi and the tables of differential diagnosis between keratosis senilis, a common precancerous lesion, keratosis seborrheicum in which carcinoma rarely develops; also between basal cell and squamous cell carcinoma of the skin. The section on venereal diseases, syphilis, gonorrhea, granuloma inguinale, lymphogranuloma venereum and chancroid is concise and describes the important syndromes occurring within the particular disease. The treatment is brought up to date and the described use of bismuth preliminary to penicillin in certain of the syphilitic syndromes is based on sound principles. In the section on standard physicotherapeutic methods essential in the treatment of many dermatoses, cryotherapy, electrolysis, surgical diathermy, iontophoresis, medicated baths, ultraviolet irradiation and the Wood light are described and their uses indicated. Roentgen and radium therapy are omitted for obvious reasons. In Part III a well rounded list of drugs and prescription formulae is presented, together with a brief description, uses and dosage. These items are correlated with their mention in the section on clinical description of the dermatoses. A useful section is concerned with removal of medicinal stains. There is a good index.

FRACTURES AND DISLOCATIONS FOR PRACTITIONERS. By *Edwin O. Geckeler,* M.D., Fellow of the American College of Surgeons, Fellow of the American Academy of Orthopaedic Surgeons, Fellow of the American Association for the Surgery of Trauma, Diplomate of the American Board of Orthopaedic Surgery. Fourth edition. Cloth. Price, $5.00. Pp. 371, with 344 illustrations. The Williams & Wilkins Company, Mt. Royal and Guilford Aves., Baltimore 2, 1951.

The number of editions of this book that have appeared within a little more than ten years testifies to its popularity. It has been reviewed previously in the ARCHIVES and needs no detailed introduction to most readers. It is a well written book on general orthopedic principles which stresses the more fundamental aspects of diagnosis and conservative treatment. It is written primarily for the general practitioner and the medical student and therefore its material is considerably condensed. In a few instances this reviewer felt that the surgical treatment of certain common fractures was discussed too briefly. For example, the only method of internal fixation of fractures of the neck of the femur discussed by the author was that with stainless steel screws. Surely, such methods as the blade plate, Smith-Peterson nail and perhaps intramedullary fixation are commonly enough encountered by the general practitioner to warrant some mention in a book such as this.

This book contains many gems of good advice that are well worth remembering. The author is logical in his approach to the mechanics of injury and surgical correction. This is a volume that is well worth inclusion in the library of those physicians who desire a convenient and readable reference concerning the most reliable methods of treatment of fractures and dislocations.

PHYSICAL MEDICINE ABSTRACTS

Present and Future Plans for the Rehabilitation of Patients in General Hospitals. Nila Kirkpatrick Covalt.

Mod. Hosp. 76:94 (Apr.) 1951.

Despite the published information, the growing interest in the field, and the actual establishment of rehabilitation programs, it is an all too common fallacy to consider that programs of physical medicine and rehabilitation are unnecessary in acute general hospitals and belong only in institutions which care for long-term illnesses and chronic disabilities. In the majority of instances, early treatment in an acute hospital can prevent a patient, even though he may be left with a chronic disability, from becoming helpless. This lessens the burden of the ever increasing number of individuals who must be cared for in chronic hospitals or convalescent homes. An amputee needs bed positioning within 24 hours after his operation, with stump exercises instituted as rapidly as possible — often within 48 hours. A unilateral amputee can be started on crutch training after only a few postoperative days. No amount of guided exercise the patient does daily will even then be adequate to prepare him completely for prosthesis walking. Once a prosthesis is procured, the physician then refers the patient to a physical therapist for walking training. This training takes one to three months, depending upon the site or sites of the amputation (above, below the knee, or bilateral), and upon the motivation of the patient. Training can be done with outpatient visits. It is accomplished more rapidly, and with a better walking pattern, if the amputee can remain at the training center and have concentrated treatment throughout a full day. Training in the use of an arm prosthesis usually is done by an occupational therapist. That training does not take as long. It is true that there is a shortage of physicians trained in physical medicine and in the other rehabilitation techniques. There is a shortage of qualified physical therapists, qualified occupational therapists, speech therapists, social workers and other ancillary personnel necessary to furnish a total rehabilitation program, even if the physical facilities are available. The object of this discussion is to show how rehabilitation programs can be started even when trained physicians and therapists are not available and even when adequate space, or money to build adequate space in hospitals, is not procurable. It is quite possible to start programs within any presently operating facility — although adequate space should be considered and included in building programs now contemplated, and in all future planning. Physicians and physical therapists will be available in time; adequate space should be allocated pending that time.

Effect of Physical Activity on Prognosis of Poliomyelitis. Robert M. Albrecht, and Frances B. Locke.

J. A. M. A. 146:769 (June 30) 1951.

Two hundred patients from the 1949 poliomyelitis epidemic in Nassau County, New York, are reported upon in this study. In each case a detailed history of the symptoms and of the physical activities from three days before the onset of illness to a number of days after the onset was taken. The term "paralysis," as used in this report, refers to other than bulbar paralysis, unless otherwise stated. The term "meningeal stage" describes the period of the illness characterized by one or more of the following, a positive Kernig sign, stiffness of the neck or back, and pain in the head, trunk, or thighs. Physical activities were classed in the histories as follows: bed rest; light activity, such as resting at home; normal activity, such as housework, office work, school or normal play; heavy activity, such as manual labor or strenuous sports or play. The physical activities of the patients were rated by one person who, in order to exclude bias, was deliberately kept uninformed of the extent of their paralysis at the time of rating. In rating the cases, both the type and duration of activity were considered. Since the evaluation of the extent of paralysis depends on the skill of the observer, and since the paralysis itself varies with time, an attempt was made to have all the patients muscle-graded by trained physical therapists approximately six months after the onset of illness. All of the gradings were tabulated on standard forms of muscle grading used routinely by the New York State Department of Health. There was found no correlation between the severity of paralysis and the activity in the three days preceding the onset of illness; nor did activity in the three days before the onset of the meningeal stage seem to influence subsequent paralysis. The bulbar cases were too few to permit conclusions to be drawn. There is no statistically significant relationship between severity of exercise and severity of paralysis, except in adults. Age is a major factor in the prognosis of poliomyelitis. Adults, irrespective of activity, are more severely affected than children. Factors other than age and activity, such as the nature of the virus, previous experience with it, the size of the infecting dose and constitutional factors, are of major importance in the prognosis of poliomyelitis.

PRELIMINARY PROGRAM

THIRTIETH ANNUAL SCIENTIFIC SESSION
AND
INSTRUCTION SEMINAR

American Congress of Physical Medicine

August 25-29, 1952
ROOSEVELT HOTEL NEW YORK, N. Y.

SCHEDULE OF INSTRUCTION SEMINAR

MONDAY, AUGUST 25

10:00 to 10:50—(A) **Physiologic Basis of Therapeutic Exercise.** HELLEBRANDT. Vanderbilt Room.

10:00 to 10:50—(1) **Vocational Counseling.** USDANE. Grand Ballroom.

11:00 to 11:50—(B) **Physiologic Basis of Therapeutic Exercise.** HELLEBRANDT. Vanderbilt Room.

11:00 to 11:50—(2) **Back Pain — Problems in Industry.** RUSSEK. Grand Ballroom.

3:00 to 3:50—(C) **Functional Anatomy of Spine.** MARKEE. Vanderbilt Room.

3:00 to 3:50—(3) **Treatment of Cerebral Palsy.** PERLSTEIN. Grand Ballroom.

4:00 to 4:50—(D) **Functional Anatomy of Forearm and Hand.** MARKEE. Vanderbilt Room.

4:00 to 4.50—(4) **Evaluation of Cerebral Palsy Child.** PERLSTEIN. Grand Ballroom.

TUESDAY, AUGUST 26

8:30 to 9:20—(E) **Present Status (Experimental) of Ultrasonics.** F. KRUSEN. Vanderbilt Room.

8:30 to 9:20—(5) **Modern Upper Extremity Prosthesis and Rehabilitation of Upper Extremity Amputees.** Lecturer to Be Announced. Grand Ballroom.

WEDNESDAY, AUGUST 27

8:30 to 9:20—(F) **Electromyographic Studies in Poliomyelitis.** KNOWLTON. Vanderbilt Room.

8:30 to 9:20—(6) **Practical Psychiatric Problems of Which the Physiatrist Should Beware.** SULLIVAN. Grand Ballroom.

THURSDAY, AUGUST 28

8:30 to 9:20—(G) **Research Methodology.** LION. Vanderbilt Room.

8:30 to 9:20—(7) **Supportive and Assistive Splinting of the Upper Extremity.** BENNETT. Grand Ballroom.

FRIDAY, AUGUST 29

8:30 to 9:20—(H) **Effects of Age on Physiologic Function and Its Implications in Rehabilitation.** THEWLIS. Vanderbilt Room.

8:30 to 9:20—(8) **Basic Mechanical and Muscular Elements in Pathologic Gaits.** BECHTOL. Grand Ballroom.

LECTURERS FOR INSTRUCTION SEMINAR

CHARLES O. BECHTOL, M.D. (by invitation), Clinical Professor of Orthopaedic Surgery, University of California, School of Medicine, San Francisco, Calif.;

ROBERT L. BENNETT, M.D., Director of Physical Medicine, Georgia Warm Springs Foundation, Warm Springs, Ga ; Professor of Physical Medicine, Emory University School of Medicine, Emory Univ , Ga ;

FRANCES A. HELLEBRANDT, M.D., Professor of Physical Medicine, Head of Department of Physical Medicine and Rehabilitation, University of Illinois College of Medicine, Chicago, Ill ;

G. CLINTON KNOWLTON, Ph.D. (by invitation), Physiology Dept , Emory University School of Medicine, Emory University, Ga ;

FRANK H. KRUSEN, M.D., Professor of Physical Medicine and Rehabilitation, Mayo Foundation, and Head of Section on Physical Medicine and Rehabilitation, Mayo Clinic, Rochester, Minn ;

KURT S. LION, Ph.D. (by invitation), Associate Professor of Applied Biophysics, Biology Dept , Massachusetts Institute of Technology, Cambridge, Mass ;

JOSEPH E. MARKEE, B S., Ph.D. (by invitation), Professor and Chairman, Department of Anatomy, Duke University School of Medicine, Durham, N C ;

M. A. PERLSTEIN, M.D. (by invitation), Pediatric Department, Northwestern University and Cook County Graduate School of Medicine, Chicago, Ill ,

ALLEN S. RUSSEK, M.D., Assistant Professor of Physical Medicine and Rehabilitation, New York University College of Medicine, New York, N Y.;

JOSEPH D. SULLIVAN, M.D. (by invitation), Instructor of Psychiatry, Cornell University Medical College and Columbia University College of Physicians and Surgeons, New York, N Y ;

MALFORD W. THEWLIS, M.D. (by invitation), Director, Thewlis Clinic; Consulting Physician, South County Hospital, Wakefield, R. I

WILLIAM M. USDANE, B.A. (by invitation), Executive Director, Vocational Rehabilitation Dept., Chief of Special Placement, Institute for the Crippled and Disabled, New York, N. Y.

Date..

APPLICATION FOR INSTRUCTION SEMINAR

In Conjunction with the
30th Annual Scientific and Clinical Session
of the

AMERICAN CONGRESS OF PHYSICAL MEDICINE

August 25-29, 1952
The Roosevelt Hotel, New York, N. Y.

Name..
(Please print)

Address..
(Please print)

Member A.M.A.......................Member County Medical Society

....
(Give Name)

If Government Service, state briefly..

....

Note: Members in good standing of the American Registry of Physical Therapists or the American Occupational Therapy Association are also eligible to attend.

Make up schedule in space below, listing courses by hour, day and number and/or letter (watch, please do not duplicate):

....
(Signature in Ink)

Please make check payable to and mail with application to

American Congress of Physical Medicine
30 North Michigan Avenue Chicago 2, Illinois

GENERAL INFORMATION

RULES GOVERNING THE READING OF PAPERS

No paper or address before the Congress shall occupy more than fifteen minutes in its delivery. The program is so arranged that all the time is utilized and it is therefore imperative that the stated time schedule be closely followed.

All papers read before the Congress shall become the property of the Congress for publication in the official journal. Each paper shall be deposited with the secretary of the section when read.

THE CONVENTION

The registration desk will be open at 10:00 a. m., Monday, August 25 for registration. It is important that everyone register before entering the lecture hall. Those not wearing the official badge will be refused admission. This meeting is not open to the public. No registration fee will be charged.

BUSINESS SESSIONS

The annual business meetings for the members of the Congress will be held on Monday, August 25, at 8 p. m., and on Tuesday, August 26, at 4:30 p. m.

CONGRESS DINNER

The annual Congress dinner will be held on Wednesday evening, August 27 at 7:00 p. m., dress is optional. Exhibitors and guests are welcome. An interesting but brief dinner program has been arranged. You will enjoy this session, the only social function of the convention.

THE INSTRUCTION SEMINAR

Courses are offered in two separate groups: One group, designated by letters, consists of eight lectures on basic subjects. A second group of eight lectures, designated by numerals, will present more general and clinical subjects. Physicians as well as physical therapists who are registered with the American Registry of Physical Therapists will be permitted to register for these courses. Members in good standing of the American Occupational Therapy Association are also eligible to enroll for the instruction course.

The schedule of the seminar, as arranged, will permit attendance at both the course and scientific sessions.

Each registrant for the course is allowed the choice of one lecture during a period. The charge for the complete schedule of eight lectures is $15.00. Fewer than eight lectures may be scheduled at $2.00 per lecture. The right is reserved to reject any application if the Course Committee finds it desirable to do so, Registration for specific courses cannot be guaranteed when quotas are filled.

Those who have not completed their registration for the course should do so before attending any of the lectures. No one will be admitted to any of the course lectures without the official registration card for the course. Registration for the course may be completed on Monday, August 25, starting at 8.00 a. m., and continuing throughout the week starting at 8:00 a. m. at the main registration desk.

AMERICAN SOCIETY OF PHYSICAL MEDICINE AND REHABILITATION

The American Society of Physical Medicine and Rehabilitation will hold its annual meeting and dinner, 7:00 p. m., Thursday, August 28.

EDUCATIONAL CONFERENCE

The Educational Conference is open to members of the Congress and others by invitation. The Conference will convene at 2:00 p. m., Monday, August 25. An interesting program has been planned.

SCIENTIFIC EXHIBITS

Scientific exhibits will be on display again and should prove of great interest. As was the custom formerly, medals will be awarded to those exhibits which are adjudged the outstanding ones by the committee on scientific awards and will be announced at the annual Congress dinner.

TECHNICAL EXHIBITS

The program of the scientific sessions and instruction seminar has been arranged with intermission periods to give time for visits and inspection of the technical exhibits. As these exhibits have been arranged with considerable effort, we urge every member and guest to set aside sufficient time for a complete tour of all exhibits.

Exhibits will be open from 9:00 a. m., to 5:00 p. m., Tuesday, August 26 through Thursday, August 28, and Friday, August 29 till 12:00 noon.

EDITORIAL BOARD

The annual meeting of the Editorial Board will be held Tuesday, August 26, 6:30 p.m., at dinner.

AMERICAN REGISTRY OF PHYSICAL THERAPISTS

The annual meeting of the Boards of the Registry will be held Wednesday, August 27, 12:30 p.m. at luncheon.

HYDROTHERAPY GROUP

There will be a subscription luncheon meeting for the group interested in hydrotherapy on Tuesday, August 26 at 12:15 p.m.

VETERANS ADMINISTRATION

Official Meeting of Veterans Administration Chief Consultant, and Area Consultants, Physical Medicine and Rehabilitation, Co-Chairmen, Donald A. Covalt, M.D., A. B. C. Knudson, M.D., Monday, August 25, 9:00 a.m. to 12:00 noon.

Annual V.A. luncheon for Chiefs, Consultants and Attending Physiatrists, Physical Medicine and Rehabilitation, Thursday, August 28, 12:15 p.m.

SCIENTIFIC FILMS

Several scientific films will be shown during time of convention.

COMMITTEE ON ARRANGEMENTS NEW YORK SOCIETY OF PHYSICAL MEDICINE

Hans J. Behrend, M.D., Chairman
Arthur S. Abramson, M.D.
Donald A. Covalt, M.D.
Cassius L. de Victoria, M.D.
Otto Eisert, M.D.
Morton Hoberman, M.D.
Madge C. L. McGuinness, M.D.

SCHEDULE OF DAILY ACTIVITIES

30TH ANNUAL SESSION

MONDAY, August 25

8:00 A.M.	Registration, Mezzanine
9:00 A.M.	Meeting, Veterans Administration Consultants (See bulletin board for room number)
10:00 A.M.	Board of Governors, Congress, Vanderbilt Room, #6
10:00 A.M.	Instruction Seminar, Vanderbilt Room, #3 4 5
10:00 A.M.	Instruction Seminar, Grand Ballroom
11:00 A.M.	Instruction Seminar, Vanderbilt Room, #3 4 5
11:00 A.M.	Instruction Seminar, Grand Ballroom
12:00 Noon	Luncheon
12:15 P.M.	Luncheon, Advisory Committee on Education, Council on Physical Medicine and Rehabilitation, American Medical Association (by invitation), (See bulletin board for room number)
1:00 P.M.	Scientific Films, Small Ballroom
2:00 P.M.	Educational Conference Small Ballroom
3:00 P.M.	Instruction Seminar, Vanderbilt Room, #3 4 5
3:00 P.M.	Instruction Seminar, Grand Ballroom
4:00 P.M.	Instruction Seminar Vanderbilt Room, #3 4 5
4:00 P.M.	Instruction Seminar Grand Ballroom
6:00 P.M.	Executives Dinner Vanderbilt Room, #1
8:00 P.M.	First Congress Business Meeting — Congress Members Only — Grand Ballroom

TUESDAY, August 26

8:00 A.M.	Registration, Mezzanine, Inspection of Exhibits
8:30 A.M.	Instruction Seminar, Vanderbilt Room, #3 4 5
8:30 A.M.	Instruction Seminar, Grand Ballroom
10:00 A.M.	Scientific Program, Grand Ballroom
12:00 Noon	Luncheon — Inspection of Exhibits
12:15 P.M.	Subscription Luncheon, Hydrotherapy Group, Vanderbilt Room #3 4
1:00 P.M.	Scientific Films Small Ballroom
2:00 P.M.	Formal Opening Session, Grand Ballroom
4:30 P.M.	Second Congress Business Meeting — Congress Members Only — Grand Ballroom
6:30 P.M.	Editorial Board Dinner, Vanderbilt Room #1

WEDNESDAY, August 27

8:00 A.M.	Registration Mezzanine — Inspection of Exhibits
8:30 A.M.	Instruction Seminar, Vanderbilt Room, #3 4 5
8:30 A.M.	Instruction Seminar, Grand Ballroom
10:00 A.M.	Scientific Program Grand Ballroom
12:00 Noon	Luncheon — Inspection of Exhibits
12:30 P.M.	Registry Board Luncheon (by invitation), Vanderbilt Room, #1
1:00 P.M.	Scientific Films, Small Ballroom.
2:00 P.M.	Scientific Program, Grand Ballroom
6:00 P.M.	Cocktail Hour — Host, New York Society of Physical Medicine
7:00 P.M.	Annual Congress Dinner, Hendrik Hudson Room

THURSDAY, August 28

8:00 A.M.	Registration, Mezzanine — Inspection of Exhibits
8:30 A.M.	Instruction Seminar, Vanderbilt Room, #3 4 5
8:30 A.M.	Instruction Seminar, Grand Ballroom
10:00 A.M.	Scientific Program, Grand Ballroom
12:00 Noon	Luncheon — Inspection of Exhibits
12:15 P.M.	Veterans Administration Personnel Luncheon, Hendrik Hudson Room
1:00 P.M.	Scientific Films, Small Ballroom
2:00 P.M.	Scientific Program, Grand Ballroom
4:30 P.M.	Board of Governors, Society, Vanderbilt Room #1
7:00 P.M.	Society Dinner, Hendrik Hudson Room

FRIDAY, August 29

8:00 A.M.	Registration, Mezzanine — Inspection of Exhibits
8:30 A.M.	Instruction Seminar, Vanderbilt Room, #3 4 5
8:30 A.M.	Instruction Seminar, Grand Ballroom
10:00 A.M.	Board of Governors, Congress, Vanderbilt Room, #1
10:00 A.M.	Scientific Program, Grand Ballroom
12:00 Noon	Luncheon

EDUCATIONAL CONFERENCE

MONDAY, August 25 — 2:00 P. M.

Small Ballroom

Chairman — Earl C. Elkins, Rochester, Minn.

1. **University Sponsored Graduate Fellowship Training in the Medical Specialties.**

   Kendall Brooks Corbin, M.D. (by invitation), Associate Director, Mayo Foundation for Medical Education and Research, University of Minnesota Graduate School, Rochester, Minn.

2. **Method of AMA Residency Approval.**

   Author to be announced

3. **Undergraduate Instruction in Physical Medicine and Rehabilitation.**

   Author to be announced

4. **Report of the Advisory Committee of the Council on Physical Medicine and Rehabilitation of the American Medical Association — Earl C. Elkins, M.D., Chairman.**

GENERAL SCIENTIFIC SESSION

TUESDAY, August 26 — 10 A. M.

Grand Ballroom

OFFICERS OF THE SECTION

Chairman — Walter M. Solomon, Cleveland
Secretary — George M. Piersol, Philadelphia

1. **Studies on Anterior Poliomyelitis Patients with Respiratory Paralysis.**

   O. Leonard Huddleston, M.D., Clinical Professor of Physical Medicine, Department of Physical Medicine, University of Southern California, School of Medicine, Los Angeles.

   Discussion: Hart E. Van Riper, M.D. (by invitation) New York, N. Y.

2. **Scapular Fixation by Bracing in Serratus Anterior Palsy.**

   Allen S. Russek, M.D., Assistant Professor of Physical Medicine and Rehabilitation, New York University College of Medicine, New York,

   and

   Morton Marks, M.D. (by invitation), Instructor, Department of Physical Medicine and Rehabilitation, New York University College of Medicine, New York.

   Discussion: Odon F. von Werssowetz, M.D., Nashville, Tenn.

3. **The Role of Lordosis in Back Pain.**
HAROLD LEFKOE, M.D., Department of Physical Medicine and Rehabilitation, Philadelphia General Hospital, Philadelphia.
Discussion Shelby Gamble, M.D., Columbus, Ohio

4. **So-Called Spastic Flat Foot.**
ROBERT W. NEWMAN, M.D., Professor of Orthopedic Surgery, State University of Iowa Medical School, Iowa City, Iowa
Discussion: Jerome Weiss, M.D., Brooklyn, N. Y.

5. **Final Results in Traumatic Cases Receiving Physical Therapy: By Improved Methods of First Aid and Safe Transportation.**
ROBERT C. HUGHES, M.D., Staff Surgeon, Chester County Hospital, West Chester, Pa.,
and
MILLARD CROLL, M.D. (by invitation).
Discussion: Solomon Winokur, M.D., New Orleans, La.

6. **The Influence of the Frequency of Muscle Stimulation on the Circulation in the Stimulated Extremity.**
KHALIL G. WAKIM, M.D. (by invitation), Professor of Physiology, Mayo Foundation, Rochester, Minn
Discussion Herbert W. Park, M.D., Fishersville, Va

7. **Skin Temperature in Relation to Nerve Injuries in Man.**
HERBERT SHAPIRO, Ph.D. (by invitation), Assistant Professor of Physical Medicine, Graduate School of Medicine, University of Pennsylvania;
GEORGE M. PIERSOL, M.D., Professor of Medicine, Graduate School of Medicine, University of Pennsylvania,
and
EMERY K. STONER, M.D., Instructor in Physical Medicine, Graduate School of Medicine, University of Pennsylvania, Philadelphia
Discussion Glenn Gullickson, Jr., M.D. (by invitation), Minneapolis, Minn

GENERAL SCIENTIFIC SESSION

TUESDAY, August 26 — 2 P. M.

Grand Ballroom

OFFICERS OF THE SECTION

Chairman — Robert L. Bennett, Warm Springs, Ga
Secretary — Frances Baker, San Mateo, Calif

OPENING OF THE 30TH ANNUAL SESSION

INVOCATION

The Reverend Charles P. Deems,
St. Bartholomew's Church, New York

ADDRESSES OF WELCOME

John Garlock, M.D.,
President-Elect,
Medical Society of the County of New York

Hans J. Behrend, M.D.,
President, New York Society of Physical Medicine

1. **The Training of a Physiatrist.**
ROBERT L. BENNETT, M.D., Director of Physical Medicine, Georgia Warm Springs Foundation, Warm Springs, Ga., Professor of Physical Medicine, Emory University Medical School, Emory University, Ga

2. **The Present Status of Ultrasonic Therapy.**
J. F. K. LEHMANN, M.D. (by invitation), Fellow, Mayo Clinic, Rochester, Minn
Discussion Fritz Friedland, M.D., Framingham, Mass

3. **Serum Neuritis: An Analysis of [illegible]teen Cases.**
ARTHUR L. W[illegible] [illegible]stant Clinical Professor of Med[illegible] School, and Chief of Physical Medicine, Massachusetts General Hospital, Boston
Discussion Joseph Moldaver, M.D. (by invitation), New York, N. Y.

4. **Rehabilitation of the Hand in Rheumatoid Arthritis.**
FRANCES BAKER, M.D., Director, Department of Physical Medicine, Community Hospital, San Mateo, Calif
Discussion Donald L. Rose, M.D., Kansas City, Kans

5. **Rehabilitation in the Clinical Management of the Patient with Tuberculosis.**
EDWARD E. GORDON, M.D. (by invitation), Associate Professor of Rehabilitation Medicine, College of Physicians and Surgeons, Columbia University, New York
Discussion: Sylvester S. Zintek, M.D., Martinsburg, West Va

6. **The Use of the High Frequency Currents in Surgery.**
WILLIAM H. SCHMIDT, M.D., Associate Professor of Physical Medicine, Jefferson Medical College, Philadelphia
Discussion: William Bierman, M.D., New York, N. Y.

GENERAL SCIENTIFIC SESSION

WEDNESDAY, August 27 — 10 A. M.

Grand Ballroom

OFFICERS OF THE SECTION

Chairman — William B. Snow, New York
Secretary — Disraeli Kobak, Chicago

ULTRASONIC SYMPOSIUM

1. **Temperatures Produced in Bone by Various Methods Used in Ultrasonic Therapy: An Experimental Study.**
LEONARD F. BENDER, M.D., Fellow in Physical Medicine, Mayo Foundation, Rochester,
JULIA F. HERRICK, Ph.D. (by invitation), Associate Professor of Experimental Medicine, Mayo Foundation, University of Minnesota Graduate School,
and
FRANK H. KRUSEN, M.D., Professor of Physical Medicine and Rehabilitation, Mayo Foundation, and Head of Section on Physical Medicine and Rehabilitation, Mayo Clinic, Rochester, Minn

2. **Studies on Analgesic Effects of Ultrasonic Therapy.**
HARRY H. ROSENTHAL, M.D., Instructor in Medicine, New York University, New York
Discussion of foregoing papers Paul A. Nelson, M.D., Cleveland, Ohio.

3. **Ultrasonic Effects on Muscle, an Experimental Study.**
JEROME W. GERSTEN, M.D., Assistant Professor, Department of Physical Medicine and Rehabilitation, University of Colorado Medical Center, Denver.
Discussion Herman J. Bearzy, M.D., Dayton, Ohio

4. **Comparative Evaluation of Ultrasound and Ultra High Frequency Diathermy in Medicine.**
HERMAN P. SCHWAN, Ph.D. (by invitation), Assistant Professor of Physical Medicine, University of Pennsylvania, Graduate School of Medicine,
and
EDWIN L. CARSTENSEN, B.S., M.S. (by invitation), Research Associate in Electrical Engineering, University of Pennsylvania, Graduate School of Medicine, Philadelphia, Pa
Discussion of foregoing papers: Thomas P. Anderson, M.D., Hanover, N. H.

5. **Evaluation of the Clinical Use of Ultrasonics.**
BRUCE B. GRYNBAUM, M.D., Director of Rehabilitation, Physical Medicine and Rehabilitation, Department of Hospitals, New York

6. **Ultrasonics in Osteoarthritis.**
FERDINAND F. SCHWARTZ, M.D., Assistant Professor of Clinical Physical Medicine, Medical College of Alabama, Birmingham, Ala
Discussion of foregoing papers. Ralph E. DeForest, M.D., Chicago, Ill.

GENERAL SCIENTIFIC SESSION

WEDNESDAY, August 27 — 2 P. M.

Grand Ballroom

OFFICERS OF THE SECTION

Chairman — Frank H. Krusen, Rochester, Minn.
Secretary — Arthur L. Watkins, Boston.

1. **Second John Stanley Coulter Memorial Lecture: Report on the International Congress of Physical Medicine.**
FRANK H. KRUSEN, M.D., Professor of Physical Medicine and Rehabilitation, Mayo Foundation, and Head of Section on Physical Medicine and Rehabilitation, Mayo Clinic, Rochester, Minn.

2. **Current Concepts of Electrotherapy in Peripheral Nerve Injuries.**
ELIAS M. THRONE, M.D. (by invitation), Resident in Physical Medicine, Letterman Army Hospital,
and
RAOUL C. PSAKI, M.D., Chief, Physical Medicine, Letterman Army Hospital, San Francisco, Calif.
Discussion: Stanley F. Radzyminski, M.D., Cleveland, Ohio.

3. **Prosthetic Training for Upper Extremity Amputees with Cineplasty.**
JOHN H. KUITERT, Lt. Col., MC, U.S.A., Chief, Physical Medicine Service, Walter Reed Army Hospital, Washington, D. C.
Discussion: John H. Aldes, M.D., Los Angeles, Calif.

4. **Coordination of Plastic Surgery and Physical Medicine in the Paraplegic Patient.**
GORDON S. LETTERMAN, M.D. (by invitation), Department of Surgery, George Washington University School of Medicine,
and
CHARLES S. WISE, M.D., Professor of Physical Medicine and Rehabilitation, George Washington University School of Medicine, Washington, D. C.
Discussion: Louis B. Newman, M.D., Chicago, Ill.

5. **Physiologic Responses to Generalized Heat Treatments.**
WALTER S. McCLELLAN, M.D., Associate Professor of Medicine, Albany Medical College, Albany, N. Y., and Medical Director, The Saratoga Spa, Saratoga Springs, N. Y.
Discussion: Hans J. Behrend, M.D., New York, N. Y.

6. **A Study of the Amplitude of Motor Unit Action Potentials.**
REX O. McMORRIS, M.D. (by invitation), Fellow in Physical Medicine, Mayo Foundation,
and
EDWARD H. LAMBERT, M.D. (by invitation), Assistant Professor of Physiology, Mayo Foundation, and Consultant in Physiology, Mayo Clinic, Rochester, Minn.
Discussion: H. Worley Kendell, M.D., Peoria, Ill.

7. **Fibrositic Nodules.**
HAROLD DINKEN, M.D., Professor and Head, Department of Physical Medicine and Rehabilitation, University of Colorado School of Medicine, Denver, Colo.
Discussion: John D. Currence, M.D., New York, N. Y.

8. **Function of Department of Physical Medicine in a Chronic Disease Research Institute.**
HENRY V. MORELEWICZ, M.D., Department of Physical Medicine and Rehabilitation, University of Buffalo, Chronic Disease Research Institute, Buffalo, N. Y.
Discussion: Herman J. Flax, M.D., Santurce, Puerto Rico.

GENERAL SCIENTIFIC SESSION

THURSDAY, August 28 — 10 A. M.

Grand Ballroom

OFFICERS OF THE SECTION

Chairman — A. B. C. Knudson, Washington, D. C.
Secretary — Fred B. Moor, Los Angeles.

REHABILITATION SYMPOSIUM

1. **Rehabilitation of Hard of Hearing.**
HOWARD A. CARTER, M.E., Director of Biophysical Investigations, Council on Physical Medicine and Rehabilitation, American Medical Association, Chicago.
Discussion: Charles O. Molander, M.D., Chicago, Ill.

2. **Evaluation of Speech Training in the Rehabilitation of the Aphasic.**
SAMUEL S. SVERDLIK, M.D.
Discussion: Robert W. Boyle, M.D., Fort Thomas, Ky.

3. **Patient Evaluation by Wechsler Bellevue Test.**
EVERILL W. FOWLKS, M.D., Chief, Physical Medicine Rehabilitation Service, Veterans Administration Hospital, Portland, Ore.
Discussion: Oscar O. Selke, Jr., M.D., Houston, Tex.

4. **Rehabilitation of 120 Lobotomized Patients in a VA Hospital.**
CHARLES H. REAGAN, M.D., Chief, Physical Medicine and Rehabilitation, Veterans Hospital, Tuscaloosa, Ala.
Discussion: Jack Meislin, M.D., Montrose, N. Y.

5. **Work Program for the Disabled Housewife.**
EDITH L. KRISTELLER, M.D. (*by invitation*), Instructor in Physical Medicine and Rehabilitation, Department of Physical Medicine and Rehabilitation, New York University Medical School, New York.
Discussion: Florence I. Mahoney, M.D., Memphis, Tenn.

6. **Some Follow-Up Studies in Rehabilitation at the Institute for the Crippled and Disabled.**
MARION STRAUSS LESSER, M.A. (by invitation), Research Assistant in Medicine, Columbia University College of Physicians and Surgeons,
and
ROBERT C. DARLING, M.D., Professor of Physical Medicine, Columbia University College of Physicians and Surgeons, New York, N. Y.
Discussion: George D. Wilson, M.D., Asheville, N. C.

7. **Combined Use of Hydrotherapy and Sweating Cure in Certain Arthritis Problems.**
ADAM PEYLAN, M.D., Director, Physical Medicine and Rehabilitation, Rapha, Ltd., Tel-Aviv, Israel.
Discussion: Samuel Warshaw, M.D., New York, N. Y.

GENERAL SCIENTIFIC SESSION

THURSDAY, August 28 — 2 P. M.

Grand Ballroom

OFFICERS OF THE SECTION

Chairman — Gordon Martin, Rochester, Minn.
Secretary — Nathan H. Polmer, New Orleans, La.

1. **Electrosurgery for the Treatment of Cutaneous Neoplasms.**
ANTHONY C. CIPOLLARO, M.D., Professor and Director, Department of Dermatology, New York Polyclinic Medical School and Hospital; *Associate Professor* of Clinical Medicine, Cornell University Medical College, New York.
Discussion: K. G. Hansson, M.D., New York, N. Y.

2. **Physical Medicine and Rehabilitation: Dynamic Effectiveness for Geriatric Patients.**
A. B. C. KNUDSON, M.D., Chief, Physical Medicine and Rehabilitation Division, Department of Medicine and Surgery, VA Central Office, Washington, D.C.
Discussion: Emmett M. Smith, M.D., Takoma Park, Md.

3. **Gait Studies of the Hemiplegia Patient and Their Clinical Applications.**
MORTON MARKS, M.D. (by invitation), Instructor, New York University College of Medicine, Department of Physical Medicine and Rehabilitation, New York.
Discussion: John C. Allen, M.D., Hartford, Conn.

4. **Foot Muscle Tester and Exerciser.**
WILLIAM BIERMAN, M.D., Assisting *Clinical Professor*, Physical Medicine and Rehabilitation, College of Physicians and Surgeons, Columbia University, New York.
Discussion: Ralph E. Worden, M.D., Columbus, *Ohio.*

5. **Assistive Activities for the Custodial Type Patient.**
MORTON HOBERMAN, M.D., Department of Physical Medicin[illegible] College of *Physicians* and Surgeons, [illegible] New York,
and
ERBERT F. CICENIA, M.A., R.P.T. (by invitation), Director of Physical Rehabilitation, New York State Rehabilitation Hospital, West Haverstraw, N. Y.
Discussion: Samuel Sherman, M.D., Pittsburgh, Pa.

6. **Rehabilitation of the Amputee Patient.**
DONALD A. COVALT, M.D., Associate Professor, Department of Physical Medicine and Rehabilitation, New York University College of Medicine; Clinical Director, Institute of Physical Medicine and Rehabilitation, New York University-Bellevue Medical Center, New York.
Discussion: Keith C. Keeler, M.D., Cleveland,Ohio.

7. **Mineral Springs in the Commonwealth of Pennsylvania (A Field Survey).**
IGHO H. KORNBLUEH, M.D., Instructor in Physical Medicine, Graduate School of Medicine, University of Pennsylvania,
and
GEORGE M. PIERSOL, M.D., Professor of Medicine, Graduate School of Medicine, University of Pennsylvania, Philadelphia, Pa.
Discussion: F. A. Hellebrandt, M.D., Chicago, Ill.

8. **Assets and Deficits of Rehabilitation in the Treatment of the Patient with Rheumatoid Arthritis.**
EDWARD W. LOWMAN, M.D., Assistant Professor, Department of Physical Medicine and Rehabilitation, New York University College of Medicine, New York.
Discussion: Richard T. Smith, M.D., Philadelphia, Pa.

GENERAL SCIENTIFIC SESSION

FRIDAY, August 29 — 10 A. M.

Grand Ballroom

OFFICERS OF THE SECTION

Chairman — William D. Paul, Iowa City.
Secretary — William Bierman, New York.

1. **The Clinical Approach to the Etiology of Cerebral Palsy.**
LEON GREENSPAN, M.D. (by invitation), Fellow in Physical Medicine and Rehabilitation, Institute of Physical Medicine and Rehabilitation, New York University-Bellevue Medical Center,
and
GEORGE G. DEAVER, M.D., Professor of Clinical Rehabilitation and Physical Medicine, New York University College of Medicine, New York.
Discussion: Harriet E. Gillette, M.D., Atlanta, Ga.

2. **Intensive Exercise Program for Early Restoration in Knee Pathology and Surgery.**
C. DEWITT DAWSON, M.D., Chief, Physical Medicine and Rehabilitation Service, VA Center, Jackson, Miss.
Discussion: Frank J. Schaffer, M.D., Fort Thomas, Ky.

3. **Essential Points in Prescribing Therapeutic Exercises in the Management of Fractures.**
HANS KRAUS, M.D.,
and
ANN B. WHITTLESEY, M.D. (by invitation), Assistant, Department of Physical Medicine and Rehabilitation, New York University-Bellevue Medical Center, New York.
Discussion: Miland E. Knapp, M.D., Minneapolis, Minn.

4. **Importance of Assistive Devices in Achieving Self-Sufficiency.**
LESLIE BLAU, M.D., Chief, Physical Medicine Rehabilitation Service, VA Center, Wadsworth, Kan.
Discussion: James W. Rae, Jr., M.D., Ann Arbor, Mich.

5. **Organization of a Rehabilitation Department in a Chronic Disease Hospital.**
SAMUEL G. FEUER, M.D., Instructor in Physical Medicine and Rehabilitation, Department of Medicine, State University Medical Center, New York.
Discussion: J. Wayne McFarland, M.D., Washington, D. C.

6. **Effect of Physical Modalities on Saphenous Circulation Time, With Use of a Radioactive Tracer.**
HARRY T. ZANKEL, M.D., Chief, Physical Medicine Rehabilitation Service, Crile Veterans Administration Hospital;
RICHARD CLARK, B.S. (by invitation), Physicist, Radioisotope Unit, Crile Veterans Administration Hospital,
and
REGINALD A. SHIPLEY, M.D. (by invitation), Associate Clinical Professor of Medicine, Western Reserve University and Director, Radioisotope Unit, Crile Veterans Administration Hospital, Cleveland, Ohio.
Discussion: Emil J. Hildenbrand, M.D., Washington, D. C.

7. **Physical Medicine and the So-Called Psychogenic Rheumatisms.**
IRVIN NEUFELD, M.D., Assistant Instructor in Orthopedic Surgery, New York Medical College, New York.
Discussion: Edward B. Shires, M.D., Norristown, Pa.

8. **The Place of Low Volt Currents in Hydrotherapy; Hydrogalvanism and Allied Currents.**
NILA KIRKPATRICK COVALT, M.D., Associate Clinical Professor of Medicine, [illegible] New Haven, Conn.; Chief of [illegible] Rehabilitation, State Veterans [illegible] Hospital for Chronic Illness,
and
JAMES E. GRIFFIN, M.A., R.P.T. (by invitation), Department of Physical Medicine, Hospital for Chronic *Illness, Rocky, Hill, Conn.*
Discussion: Joseph M. Markel, M.D., Detroit, Mich.

9. **Oscillometric Evaluation of Arterial Blood Flow in Peripheral Vascular Diseases.**
BROR S. TROEDSSON, M.D., Chief, Department of Physical Medicine, Orange Memorial Hospital, Orange, N. J.
Discussion: Wilbur A. Selle, Ph.D., Los Angeles, Calif.

10. **Treatment of Spondylitis.**
BEN L. BOYNTON, M.D., Chief, Physical Medicine Rehabilitation Service, Veterans Administration Hospital, Houston, Texas;
LEWIS A. LEAVITT, M.D. (by invitation), Assistant Professor, Physical Medicine and Rehabilitation, Department of Neuropsychiatry, Baylor University College of Medicine;
ROXANA R. SCHNUR, M.D. (by invitation), Instructor in Physical Medicine and Rehabilitation, Baylor University College of Medicine,
and
HOWARD L. SCHNUR, M.D. (by invitation), Instructor in Physical Medicine and Rehabilitation, Department of Neuropsychiatry, Baylor University College of Medicine, *Houston, Texas.*
Discussion: Richard H. Dear, M.D., Phoenixville, Pa.

SCIENTIFIC EXHIBITS

Foot Muscle Tester and Exerciser. WILLIAM *BIERMAN, M.D.*

Progress in the Rehabilitation of the Aged. COMMISSION ON THE CARE AND TREATMENT OF THE CHRONICALLY ILL, AGED AND INFIRM, STATE OF CONNECTICUT.

Physical Medicine in Dermatology. ANTHONY CIPOLLARO, M.D.; RALPH E. DE FOREST, M.D.; FREDERIC T. JUNG, M.D., and HOWARD A. CARTER, M.E.

Integrated Rehabilitation Services at the Institute for the Crippled and Disabled. ROBERT C. DARLING, M.D.

Rehabilitation Procedures in Children with Physical Disabilities. GEORGE G. DEAVER, M.D.

Continuous Oxygen-Rich Aerosol for the Tracheotomized Respirator Patient. ROBERT DENTON, 1ST LT. USAF (MC), and JOSEPH N. SCHAEFFER, LT. COL. USAF (MC).

Peripheral Arterial Thrombosis and Embolism: Diagnosis and Management. SAMUEL FELDMAN, M.D.; DAVID FRIEDMAN, M.D.; MURRAY MAHL, M.D., and DAVID KERSHNER, M.D.

Rehabilitation of the Paraplegic. SAMUEL G. FEUER, M.D.

Arthritis. SIGMUND FORSTER, M.D.

The Care of the Hemiplegic Infant and Child with Tuberculous Meningitis. JEROME GERSTEN, M.D.; RHODA GERSTEN, B.A., and EVELYN MAY, R.P.T.

Improvised Rehabilitation Equipment. HERBERT KENT, M.D., and E. R. GANZA.

Rehabilitation in Otolaryngology. CLAIR M. KOS, M.D., and JACQUELINE KEASTER.

Gas Flow Rates During Respiraton. WILLIAM G. KUBICEK, Ph.D.

The "X-Ray Negative" Shoulder. HAROLD LEFKOE, M.D.

Management of the Poliomyelitis Patient with Respiratory Difficulty. NATIONAL FOUNDATION FOR INFANTILE PARALYSIS.

Building Happy, Useful Lives Through Easter Seal Services. NATIONAL SOCIETY FOR CRIPPLED CHILDREN AND ADULTS.

Table for Vertebral Elongation. EUGENE NEUWIRTH, M.D.

Physical Medicine and Rehabilitation in Acute Myocardial Infarction. L. B. NEWMAN, M.E., M.D.; L. A. BAKER, M.D.; M. F. ANDREWS, B.S., P.T., and M. O. KOBLISH, B.S., O.T.R.

Rim Fracture of Humeral Head. ROBERT W. NEWMAN, M.D.

Miniature Equipment for Cerebral Palsy. M. A. PERLSTEIN, M.D.; HARRY BARNETT, M.D., and JEROME FINDER, M.D.

Ultrasonic Scanning of Osteoporotic Bones. HARRY H. ROSENTHAL, M.D.

Rehabilitation of the Hemiplegic Housewife. HOWARD A. RUSK, M.D.; EDITH L KRISTELLER, M.D., and JOSEPH G. BENTON, M.D.

Functional Shoulder and Upper Extremity Brace-Apparatus. ROBERT B. WALLACE, M.D.

Prosthetic Training for the Upper Extremity Amputee: Special Problems for Cineplasty. WALTER REED ARMY HOSPITAL.

Paralysis Agitans. MAX WEINSTEIN, M.D.

Traction Table. EUGENE H. WEISSENBERG, M.D.

Self-Help Devices for Rehabilitation. MURIEL E. ZIMMERMAN, O.T.R., and HOWARD A. RUSK, M.D.

TECHNICAL EXHIBITS

AMERICAN HOSPITAL SUPPLY CORPORATION.

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ARCHIVES OF PHYSICAL MEDICINE

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ORIGINAL ARTICLES

Tables for Vertebral Elongation in the Treatment of Sciatica. Eugene Neuwirth, M.D.; Winifred Hilde, R.P.T., and Rex Campbell, B.S. 455
Discussed by Dr. Ray Piaskoski.

Therapeutic Application of Ultrasonic Energy. Fritz Friedland, M.D.; John G. Bisgrove, M.D., and Bernard J. Doyle, M.D. 461
Discussed by Dr. W. A. Selle.

The Repetimeter. Robert A. Schlesinger, M.D. 468
Discussed by Drs. Louis P. Biro, and Sedgwick Mead.

Educational Therapy in the Veterans Administration Rehabilitation Program. Louis B. Newman, M.D., and Irving R. Popell, M.A. 477
Discussed by Dr. C. O. Molander.

Combination Therapeutic Tank and Pool. Samuel Sverdlik, M.D. 486
Discussed by Drs. John D. Currence; Jack Meislin; Fred Fricke, and S. Sverdlik.

•

Medical News 489

•

Editorial 491

•

Book Reviews 495

•

Physical Medicine Abstracts 501

•

EDITOR OF THE MONTH

FREDERIC J. KOTTKE, M.D.

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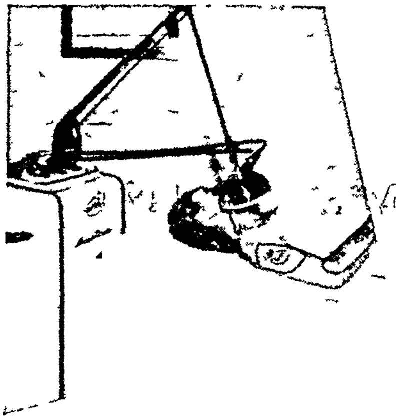

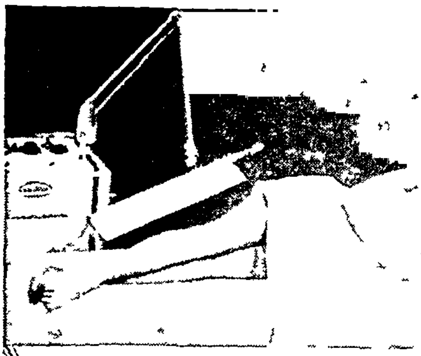

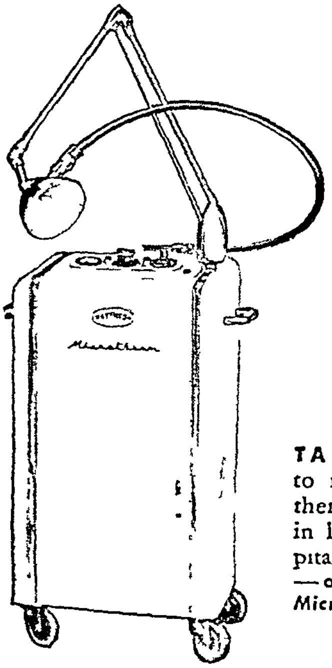

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TABLES FOR VERTEBRAL ELONGATION IN THE TREATMENT OF SCIATICA *

EUGENE NEUWIRTH, M.D.†
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and
REX CAMPBELL, B.S.§

WHIPPLE, ARIZONA

The term sciatica implies pain beginning in the lower lumbar and the sacroiliac areas and spreading down the posterior aspect of one of the lower extremities. The pain may be accompanied by objective changes, such as sensory alterations, decrease in muscle volume and in motor power, and altered muscle reflexes.

In recent years it has been established that sciatica is due in more than 95 per cent of the patients to lesions involving spinal nerve roots. It also has been found that more than 90 per cent of the root lesions result from protrusion of one or more of the lumbar intervertebral disks.[1]

Radicular sciatica is sometimes due to osteoarthritis involving the lumbar vertebrae. However, it should be kept in mind that the vertebral column may be studded with bony outgrowths without resulting in sciatic pain. On the other hand, it should also be remembered that discopathy itself through disruption of the statics and dynamics of the vertebral segment concerned may also lead to bony overgrowth on the relevant vertebrae (disco-osteophytosis or discarthrosis).

Pathological processes other than disk protrusion and osteoarthritic changes may involve the fourth and fifth lumbar and the first sacral roots and thus produce sciatic pain. The pathologic processes include tumors of the spinal cord, the nerve roots and the cauda equina; syphilis of the spinal meninges; further, diseases of the vertebral column, such as primary or secondary neoplasms, tuberculosis, brucellosis, osteomyelitis, osteomalacia, advanced osteoporosis, fractures and dislocations. Since these pathological entities represent contraindications to the application of vertebral elongation as outlined below, it is mandatory to differentiate their symptoms and signs from those of disk protrusion.

The Intervertebral Disk

The intervertebral disks constitute about one-fourth of the entire length of the vertebral column. At its circumference, the disk consists of concentric layers of dense fibrous tissue, the annulus fibrosus, which surrounds a soft, pulpy and elastic substance, the nucleus pulposus.

The nucleus pulposus is particularly well developed in the lumbar disks. It has a water content of 80 per cent and behaves like a shock absorbing cushion obeying the laws of fluids. Under physiologic or pathologic pressure,

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* From the Physical Medicine Rehabilitation Service, Veterans Administration Center, Whipple, Arizona.

* Reviewed in the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the authors are the result of their own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

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[1] Millikan, Clark, H.: Sciatica, J. A. M. A. 145:1 (Jan. 6) 1951.

e. g., in the bearing of body weight in the upright position, the nucleus is distributed in all directions and pushes the fibrous ring outward. Too much force exerted upon the disk, especially in the most mobile segments of the vertebral column, i. e., C6-T1 and L4-S1, may cause the thinner posterior part of the annulus to burst, allowing the nucleus pulposus to escape through the tear. The disk substance may project into the vertebral canal and exert pressure upon a spinal nerve root.

Treatment

Treatment of sciatica of disco-radicular origin may be conservative or surgical. The conservative measures include: administration of analgesic drugs, rest in bed on a firm mattress, the application of heat and massage, the wearing of a fitted low back support. The patient is cautioned against lifting heavy weights, and against any undue exertion that would tend to increase protrusion of the disk.

There is no doubt that many cases of sciatica recover by employment of conservative therapeutic measures. Surgery usually is performed in severe and protracted cases of sciatic pain, or where there are repeated attacks of violent pain, or whenever thorough and seemingly adequate trial with conservative therapy fails to relieve pain.

However, operative results are not always satisfactory. In addition, hospitalization and postoperative convalescence may last for months. Hence, it is suggested that when there is no absolute indication for surgical interference, elongation of the lumbar segment of the vertebral column should be tried to relieve sciatic pain.

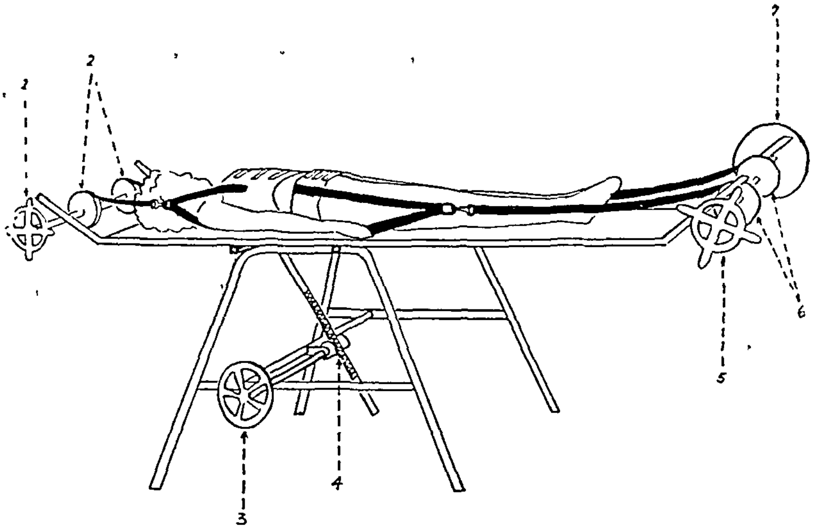

Figure 1. —Lumbar traction by means of the Godet table for vertebrotherapy. 1, Handwheel; 2, pulleys, 3, handwheel; 4, wormgear; 5, handwheel; 6, pulleys, 7, dynamometer.

Among the conservative measures, rest in bed on a firm mattress appears to be the most effective one in the management of sciatica. With the spine in the horizontal position, forces are removed which in the upright position act on the vertebral column, especially on the intervertebral disks. Therefore, in the treatment of sciatica caused by disk protrusion or bony outgrowths, it would seem reasonable to apply to the lumbosacral segment the forces that are the reverse of those operative in the erect position.

Tables for Vertebral Elongation

Since antiquity there have been attempts to treat painful conditions caused by vertebral disorders. Data referring to vertebral traction may be found as early as the fifth century B. C. in the writings of Hippocrates.[2] He describes various procedures to redress kyphosis, and particularly recommends the use of a ladder to which the patient is bound, head up or down, and then lifted by a rope which runs over a pulley attached to the roof of a house. Then the ladder with the patient is dropped onto a hard pavement.

Today there are numerous tables by means of which vertebral elongation is accomplished. The table designed by Lucien Godet (fig. 1) is easy to handle and permits gentle and progressive traction to be applied to the cervical, the thoracic or the lumbar segment of the vertebral column. The feasibility of segmental traction is a very important and useful feature of the table.

The table is so constructed that it can be tilted in both directions, head up and head down, on a central transverse axis. The tilting is accomplished by turning a handwheel which acts upon a worm gear. The table top is composed of plexiglass or bakelite to permit passage of roentgen rays.

At both ends of the table, slightly above its level, pulleys are mounted upon transverse axes: three pulleys at the head and two at the foot end. Over these pass the straps of the head sling and the chest and the pelvic corsets applied to the patient. The end axes are rotated by handwheels, and during treatment are maintained in position by ratchet arrangements. A dynamometer at the foot end of the table indicates in kilograms the amount of traction force employed.

The head end of the table is equipped with a detachable steel frame which carries a pulley (suggested by Neuwirth). The additional equipment permits suspension by head sling of patients who do not tolerate dorsal decubitus.

The principal features of a table designed and built by two of us (Neuwirth and Campbell, fig. 2), are the following:

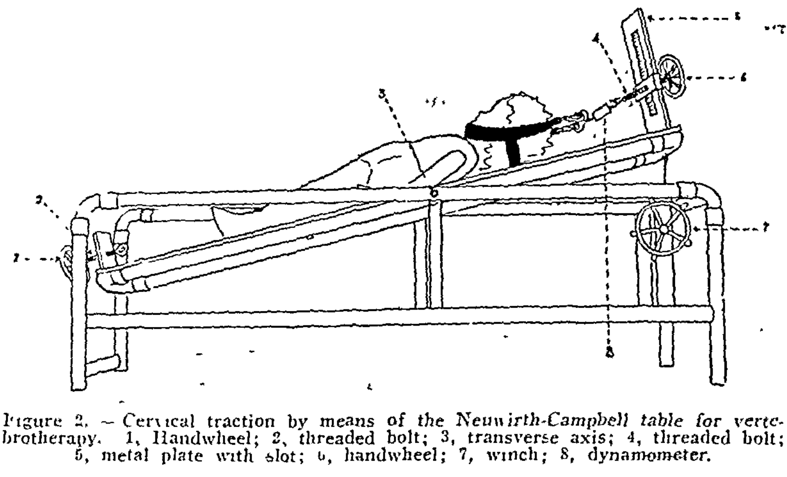

Figure 2. — Cervical traction by means of the Neuwirth-Campbell table for vertebrotherapy. 1, Handwheel; 2, threaded bolt; 3, transverse axis; 4, threaded bolt; 5, metal plate with slot; 6, handwheel; 7, winch; 8, dynamometer.

The foot end of the table, lowered by its own weight, is returned to the horizontal plane by means of a winch.

At the head, a metal plate is mounted with a central slot along which a threaded bolt slides up and down. This permits traction in line with the long axis of the vertebral column and also allows cervical traction at different degrees (up to 25) of flexion.

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[2] de Seze, S., and Levernieux, J.: La traction sur table de vertèbrothèrapie, La Presse Mèdicale, p. 28 (Jan. 5) 1949; Vertébrothèrapie manuelle et vertébrotherapie mècanique, 3rd *Scientific Congress of Masso-kinèsitherapie* (March 12-13) 1949, Précisions sur l'emploi des tractions vertebrales, Rev. du Rhumatisme 17:303 (June) 1950.

Another threaded bolt passes through the central opening of a smaller metal plate mounted at the foot end of the table. The straps of the head sling as well as those of the torso corsets are fastened to traction bars. The traction bar at the head is attached to the threaded bolt by a dynamometer.

Vertebral traction is performed by operating the handwheels, which turn the threaded bolts.

Technique

Before treatment with the elongation table, it is imperative to rule out any contraindications. After preliminary use of heat and sedative massage to the area of the vertebral segment to be elongated, traction is applied and its intensity gradually increased. At the end of a few minutes, the traction force is slowly and gradually reduced to the starting point. After a short pause, traction is reapplied and increased to a higher level. In progressive stages maximal traction is attained and maintained for about eight to ten minutes. Return to the starting level should be accomplished just as slowly, without jerks or sudden stops. Rest for thirty to sixty minutes should follow the treatment. Treatment is given daily or every other day. This technique, combined with bed rest, is employed in acute cases of sciatica. In chronic cases, traction is performed without bed rest intervals. If six consecutive treatments fail to effect relief of sciatic pain, vertebral elongation therapy is discontinued.

If the patient is unable to lie on his back, vertebral traction may be executed in ventral decubitus.

In the treatment of sciatic pain, vertebral elongation treatment may be advantageously supplemented by the wearing of a low back support, and sleeping on a firm nonsagging mattress or bed boards.

Roentgenological studies can be made before, during and after treatment.

Cervical Traction

The patient lies on his back; the head sling is applied to the chin and the occiput. The straps of the head sling run over the pulleys (Godet) or to the traction bar (Neuwirth and Campbell) at the head end of the table. The table is slowly inclined, foot end down. This permits the body to slide downward. The degree of inclination determines the degree of traction force operating which is indicated on spring scales, or the dynamometer (fig. 2).

Or the table top remains in the horizontal position, and traction force is applied by turning the hand wheel at the head of the table.

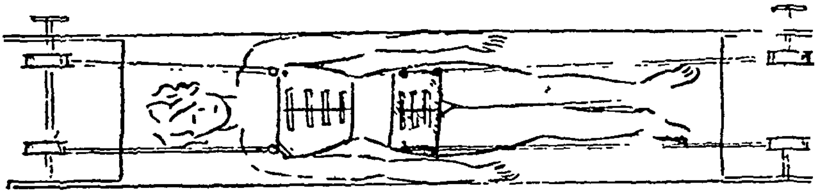

Figure 3. — Lumbar Traction.

Thoracic Traction

The patient lies on his back with head sling fitted as above and the pelvic belt fitting snugly over the iliac crests, its straps passing over the pulleys or to the traction bar at the foot end of the table. The hand wheel here is turned. Simultaneously the table may be inclined head downward.

Lumbar Traction

The patient lies on his back with hips extended or flexed and both thoracic and pelvic corsets applied. The straps of the corsets run over the pulleys or to the traction bars at the respective ends of the table (fig. 3). Both end hand wheels are turned and traction is applied, producing elongation of the lumbar segment (fig. 1).

Mechanical Effects

Vertebral traction or elongation, after effacing the curvature of the spinal segment receiving treatment, above all, widens the intervertebral spaces, the apophyseal joint spaces and the intervertebral foramens. The latter are often found constricted and deformed because of secondary consequences of discopathy, such as the bulging of disk substance or of newly formed bone into them, or because of vertebral displacement, or subluxation of the apophyseal joints.

Furthermore, vertebral traction stretches the structures that are connected with the vertebral segment treated, such as the intervertebral disk, the anterior and the posterior longitudinal ligaments, the intertransverse, the interopophyseal, the yellow, the supra- and the interspinous ligaments, the capsules of the apophyseal joints, and, finally, the muscles. Muscle tissue resists the force of traction by virtue of its elasticity and contractility. Adhesions which may have developed between the protruded disk and the nerve root are also subjected to stretching.

Vertebral elongation relieves muscle spasm, promotes the return of the protruded disk and the slightly displaced vertebrae to their original lodging, and facilitates reduction of the subluxated apophyseal joints; the pressure exerted upon the nerve root, the blood vessels, and the lymphatics is removed, with consequent relief of pain and restoration of both the blood and the lymph circulation. In short, vertebral elongation tends to reproduce the anatomical and physiological conditions that existed prior to the development of sciatica.

To increase the intervertebral space, adequate traction force is needed. Pertinent studies[3] show that in a cadaver of which the lumbar segment is stripped of muscles, nine kilograms of traction force are necessary to separate two lumbar vertebrae by one and one-half millimeters. In the living, one hundred kilograms of traction force must be employed to attain the same result.

The effectiveness of vertebral elongation is measured by the degree of intervertebral separation attained. In general, by means of vertebral traction, the lumbar intervertebral space may be increased by one and one-half millimeters; the lumbar segment itself may be lengthened by eight to ten millimeters.

Therapeutic Results

The following results were achieved in a series of thirteen patients with sciatica who were treated with vertebral traction executed by means of the Godet table for vertebral elongation: eight completely recovered, one was improved, two were slightly improved and two failed to respond.

Not infrequently a patient improves immediately after treatment; usually, however, progress is gradual. It has not been observed that treatment is more effective when given early in the course of sciatica. Proper evaluation of treatment demands that the patient be reexamined after three to six months.

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[3] Coste, F.; Galmiche, P., and Pajault, L.: Apropos du traitement des lombo-sciatiques par les méthodes de traction, Rev. du Rhumatisme 17:298 (June) 1950.

Since our series is too small to warrant the drawing of definite conclusions, we quote the results of other writers who possess great experience with vertebral elongation therapy in the management of sciatica and other painful conditions of vertebral origin.*

S. de Sèze and J. Levernieux:[2] Sciatica, 400 patients: good results, 270 (68 per cent); Lumbalgia, 240 patients: good results, 165 (69 per cent); F. Coste, F. Galmiche, and L. Pajault:[3] Lumbosciatica, 156 patients; Recovered or much improved, 91 (58 per cent); Improved, 29 (19 per cent); Slight improvement, 13 (8 per cent); No improvement, 23 (15 per cent).

Of 47 patients treated with vertebral traction only, 32 recovered or were much improved; 9 showed slight improvement; 6 showed no improvement.[3]

Summary and Conclusions

1. Sciatica and its relationship to lumbar intervertebral disk protrusion have been discussed.
2. Vertebral traction has been found to exert significant beneficial effect in patients with sciatica.
3. Vertebral traction has been performed by means of the Godet table for vertebral elongation which allows in a simple, effective and safe manner the application of segmental traction.
4. Vertebral elongation therapy is advocated as a valuable adjunct in the management of sciatica in patients who do not respond to the heretofore usually employed conservative measures, and before surgery is decided upon.
5. Optimal results with this method of therapy are obtained by combination with sleeping on a firm mattress and the wearing of a low back support.

Discussion

Dr. Ray Piaskoski (Wood, Wisconsin): In a recent editorial by Joseph S. Barr in the Journal of Bone & Joint Surgery for Feb., 1951, he states that surgical treatment of the protruded disc is accompanied by "a failure rate of 10 per cent in skilled hands (higher in the less proficient)" and that there is a second larger group of patients, approximately 40 per cent, who, "on careful questioning admit to some degree of disability." These figures emphasize the fact that although diagnostic and surgical techniques have been greatly improved in recent years, conservative treatment is still the treatment of choice. Most physicians agree with Dr. Phillip Lewin that only when conservative treatment fails, surgical treatment should be given.

The tables described (by Dr. Neuwirth and his co-workers) appear to be a valuable addition to conservative therapy. Certainly they offer a much more accurate means of applying traction than the relatively crude methods in common use today.

Having had no personal experience with these tables I cannot venture an opinion regarding their therapeutic effectiveness. I would like to ask Dr. Neuwirth if the thirteen patients treated by him were classed as failures on routine conservative therapy before being treated with the elongation table or if they were early cases having had no previous treatment.

Just a word of caution. All mechanical gadgets involving use of force may be potentially dangerous in careless and unskilled hands. I think Dr. Neuwirth will agree with me that this treatment should be administered or at least closely supervised by a physician.

---

* Cervical and nuchal pains, cervicobrachialgia, cervicooccipital pain, cervicofacial pain, dorsalalgia, intercostal neuralgia, lumbalgia, lumbosacral osteoarthritis, painful lumbarization, painful sacralization, spondylolisthesis, etc.

Acknowledgement: We are greatly indebted to Mr. Rex H. Campbell, Mr. John W. Jellinghausen, Mr. Ronald L. Wright (Manual Arts Section), Miss Frances E. Browne, Miss Shirley O. Smith (Occupational Therapy Unit), and Mr. L. C. McIntyre (Special Services Division), all of the Veterans Administration Center, Whipple, Arizona, for their sympathetic help given in constructing, equipping and photographing the models of both the Godet and the Campbell-Neuwirth tables for mechanical vertebrotherapy.

THERAPEUTIC APPLICATION OF ULTRASONIC ENERGY [*]

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The Americans Wood and Loomis[1] were the first ones to report (1927), on the physical, chemical, and biological effects of ultrasound; however, most of the publications on ultrasonics have appeared in the European literature. According to Woeber[2] the first clinical trial with ultrasonic therapy was made in 1928 on otosclerosis and other hearing defects. Later on ultrasonics was used to transfer certain drugs through the skin which, according to Woeber,[2] was successful for some capillary dilating substances. Since 1939, many other conditions have been treated with ultrasonics by European investigators. In Horatz[3] opinion the rationale for selecting certain conditions lies in the physical and biological effects of ultrasound, namely, hyperemia, heat, and the so-called intercellular massage. Hintzelmann[4-5-6] based his selections on observations made in colloid and phono-chemistry; he chose such conditions as those in which the lesions are said to be due to reduction of the water content of the tissues; these are, according to Hintzelmann, the ankylopoietic spondylarthritis and the spondylosis deformans. Several investigators have experimentally treated tumors with ultrasound. In 1934, Nakahara and Kobayashi[7] conducted such investigations on adenocarcinomata of mice and rats. In 1940, the Americans Beck and Krantz[8] reported that ultrasounding produced an inhibition of growth of Walker sarcomata in rats. Horvath[9] in Germany reported in 1944 a successfully treated metastasis of a retothelial sarcoma of the human skin; he also claimed favorable results on carcinomata of the skin.[10-11-12] Ungeheuer[13] states that at the present time there is hardly any human disease or organ in which ultrasonic treatment has not been tried.

The technical application of ultrasound consists of connecting the sound head which contains the oscillating quartz crystal to the surface to be treated, under complete elimination of air. This is necessary to avoid interfaces between solids and air; it is accomplished by employing coupling media such as oil or water. According to Wachsmann,[14] there are principally three methods of treatment available: 1, with the stationary sound head; 2, with the slightly moving sound head; and 3, the stroking massage method. Physically, the first method results in an interference maximum, which means that with small ultrasonic intensities great effects can be obtained locally. The second method results in an effacement of the interference field. The third method also eliminates interference and in addition allows treatment of large areas. Ultrasonic doses are measured in watt per square centimeter (w/cm^2). According to Wachsmann[14] small therapeutic doses range from 0.5 to 1.5, medium doses from 1.5 to 3.0, and large doses from 3.0 to 6.0 w/cm^2; the latter are used exclusively for sounding with the massaging head. These ranges have been established empirically; Pohlman and his associates[15-16] have shown in experiments on themselves that intensities between 2 and 5 w/cm^2 produce temporary erythema and that higher intensities result in edema and blister formation. In our clinical research we have used the massaging treatment method exclusively and have never treated with intensities higher than 3 w/cm^2, doses which have been recommended by European investigators as optimal.[17]

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[*] Read at the Twenty-Ninth Annual Session of the American Congress of Physical Medicine, Denver-Colo., Sept. 5, 1951.

[*] Reviewed in the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the authors are the result of their own study and not necessarily the opinion or policy of the Veterans Administration.

[*] From the Physical Medicine Rehabilitation Service, Cushing Veterans Administration Hospital, Framingham, Massachusetts.

[†] Chief, Physical Medicine Rehabilitation Service.

[‡] Resident Physician, Physical Medicine Rehabilitation Service.

1. Wood, R. W., and Loomis, A. L.: The Physical and Biological Effects of High Frequency Sound Waves of [illegible] phic Mag. 4:417, 1927.
2. Woeber, [illegible] Erfahrungen mit Ultraschalltherapie bei Dermatosen, Strahlentherapie 79:599, [illegible].
3. Horatz, Karl: Erfahrungen mit der Ultraschallbehandlung, Strahlentherapie 79:635, 1949.
4. Hintzelmann, Ulrich: Ultraschalltherapie rheumatischer Erkrankungen, Deutsche med. Wchnschr. 72:350, 1947.
5. Hintzelmann, Ulrich: Ultraschalltherapie rheumatischer Erkrankungen, besonders des Morbus Bechterew, Strahlentherapie 79:607, 1949.
6. Hintzelmann, Ulrich: Der augenblickliche Stand der Ultraschalltherapie, Schweiz. med. Wchnschr. 33:759, 1949.
7. Nakahara, W., and Kobayashi, R.: Biological Effect of Short Exposure to Ultrasonic Waves. Local Effect on Skin, Jap. J. Exper. Med. 12:137, 1934.
8. Beck, Frances F., and Krantz, J. C., Jr.: Glycolysis in Tumor Tissue: III. The Effect of Ultrasonic Vibrations on the Growth and Glycolysis of Walker Sarcoma, Am. J. Cancer 39:245, 1940.
9. Horvath, J.: Ultraschallwirkung beim menschlichen Sarkom: I. Klinischer Teil, Strahlentherapie 75:119, 1944.
10. Horvath, J.: Über die Wirkung der Ultraschallwellen auf das menschliche Karzinom, Klinik u. Praxis 1:10, 1946.
11. Horvath, J.: Weitere Erfahrungen über die Wirkung der Ultraschallwellen auf das menschliche Karzinom, Klinik u. Praxis 1:108, 1946.
12. Horvath, J.: Morphologische Untersuchungen über die Wirkung der Ultraschallwellen auf das Karzinomgewebe, Strahlentherapie 77:279, 1947.
13. Ungeheuer, E.: Unsere Erfahrungen mit Ultraschall, Strahlentherapie 79:619, 1949.

In our studies we have used two machines, the Scillo-Ultraphonor* with a frequency of 1000 kilocycles per second (and a harmonic frequency of 3000 kilocycles per second for surface therapy) and the Ultrasonor** with a frequency of 1000 kilocyles per second. The average dose given by us ranged from 2 to 2.5 w/cm^2 applied for 4 to 10 minutes, depending on the size of the area treated. In the absence of pain or burning the dose can be considered clinically safe.

For the therapeutic effect, according to Pohlman,[16-18-19] three factors must be considered: 1, Heating due to absorption of energy; 2, cell pulsation, with its mechanical stress; and 3, chemical effects, possibly caused by breaking chemical compounds and formation of new intermediary substances. These ultrasonic effects have been discussed in the American literature by Nelson, Herrick and Krusen[20] in the January, 1950, issue of the Archives of Physical Medicine where a complete literature reference can be found. Furthermore, experimental studies at the Mayo Clinic have enriched our present knowledge of the ultrasonic effects.[21]

The report of the International Congress on Ultrasonics, held at Erlangen, Germany, in 1947,[17] mentions forty-eight indications for ultrasonic therapy, of which some were only therapeutic trials without any rationale. These indications and reported results which, in many instances, merely reflect the impression of the clinician have been critically discussed by Nelson, et al.[20]

To form an opinion on the possible damaging effect of ultrasound we have studied the European literature, where many thousands of treatments

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14. Wachsmann, F.: Applikationstechnik und Dosierung bei therapeutischen Ultraschallbehandlungen, Strahlentherapie 79:529, 1949.

15. Pohlman, R.; Richter, R., and Parow, E.: Über die Ausbreitung und Absorption des Ultraschalls im menschlichen Gewebe und seine therapeutische Wirkung an Ischias und Plexusneuralgia, Deutsche med. Wchnschr. 1:251, 1939.

16. Pohlman, R.: Die Ultraschalltherapie: Quantitative Angaben zu ihrem Wirkungsmechanismus, Deutsche med. Wchnschr. 73:373, 1948.

17. Schreiber, H., and Eckardt, W.: Ultraschall, ein neues Therapeutikum, Strahlentherapie 80:629, 1949.

* Courtesy of Scillo-Agency and Distributor in U. S. A., Fritz Oehlmann, Yonkers, New York.

** Courtesy of Ultrasonic Medical Equipment Corporation, New York, N. Y.

18. Pohlman, R.: Die Ultraschalltherapie in ihrer heutigen Entwicklung, Schweiz. med. Wchnschr. 33:754, 1949.

19. Pohlman, R.; Parow-Souchow, [illegible] H.: Über die Temperaturverteilung in Lebendem Menschlichen Organisms bei [illegible] Klin. Wchnschr. 1948:277 (May 1).

20. Nelson, Paul A.; Herrick, J. F, [illegible] H.: *Ultrasonics in Medicine*, Arch. Phys. Med. 31:6, 1950.

21. Anderson, Thomas P.; Wakim, Khalil G.; Herrick, J. F.; Bennett, Warren A., and Krusen, Frank, H.: An Experimental Study of the Effects of Ultrasonic Energy on the Lower Part of the Spinal Cord and Peripheral Nerves, Arch. Phys. Med. 32:71, 1951.

have been reported without any detrimental results. Demmel,[22] e. g., reported that in his 6000 soundings of various areas no damages were observed. We concluded that ultrasonic therapy can be considered safe if applied within the limits of therapeutic dosage and we believe that our own experience confirms this opinion. During a period of one year we have given 1477 treatments to 141 patients and have not encountered any damage except that one patient on two different occasions showed aggravation of the furuncles we treated, which, however, subsequently healed without any further complications.

In order to investigate the beneficial effect of ultrasound we have compared our cases treated by sounding with controls of comparable pathology treated by other physical therapeutic methods. The conditions which are most suitable for ultrasonic therapy are either self-limited or respond to a great number of therapeutic measures or are of such a nature that they may go into a state of remission at any time. Often the change of environment and the limitation of daily activities incident to hospitalization have a therapeutic value which alone can influence the course of events.

Cervical myositis is an illustration of such self-limited condition. Of 8 cases treated by us with ultrasound, 6 recovered within a few days, the other 2 improved. Such recovery will also occur with other therapeutic measures and a similarly speedy recovery may be observed without any therapy. In our control group treated with thermotherapy and massage we obtained the same relief of pain with the same number of treatments, ranging from 1 to 5. These observations suggest that ultrasound has an analgesic effect which is equal to, but not greater than, the effect of other physical agents such as infrared or shortwave diathermy.

In subdeltoid bursitis, pain again is the outstanding symptom, and the response to any therapy must be decided mainly by the subjective improvement of pain. The concomitant limitation of motion of the shoulder is either secondary to pain and will improve while pain decreases, or is a true contracture of the joint which can not be expected to improve under analgesic therapy. In those cases, an exercise program must accompany the pain relieving agent, whether diathermy, x-ray, ultrasound, or local injection of procaine. On 21 cases we observed that 14 became completely or almost completely asymptomatic in regard to pain, 2 had moderate relief, 3 had clinically insignificant relief, and one patient failed to respond to treatment of either shoulder. One of the improved cases (J. S.) had previously failed to respond to shortwave diathermy, and another one (L. H.) had received daily treatments of infrared, massage, and exercises for a period of three months with only slight temporary relief.

The observations of our cases of subdeltoid bursitis again suggest that ultrasonics has a local analgesic effect. Improvement often started after the first or first few treatments. The average number of ultrasonic treatments necessary to obtain an adequate relief was 10, while in a comparable group of control patients treated by thermotherapy, massage, and exercises the average number of treatments was only 7.2. The total result in the latter group was essentially the same as in the ultrasonic group. Again, there was no evidence that ultrasound has any greater symptomatic effect than conventional physical therapy.

The treatment of acute and chronic conditions of the lower back with or without accompanying sciatica, has long been one of the great problems in physical medicine. The most rational treatment in the authors' opinion is a muscle strengthening exercise program which is designed to develop a better muscular support, especially in those cases which fail to show any structural explanation for the complaints. This form of therapy, however, will not suffice to bring about an early relief of pain and therefore exercises are usually supported by some form of analgesic therapy. The following 2 cases are described as representatives of 18 from a series of 36 patients with low back pain:

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[22] Demmel, D.: Erfahrungen mit Ultraschallbehandlung, Deutsche med. Monatszeitschrift, 2:241, 1948.

J. C., aged 56, complained of low back pain of 2 days' duration following lifting. Pain was referred to the left low back region. There was marked left sided erector spinae spasm. Tenderness was present over the left sacro-iliac joint. Low back motion was painful and limited in all directions. Straight leg raising test was markedly positive on the left. Tendon reflexes were physiological. Diagnosis: Low back strain.

After 10 ultrasonic treatments there was relief of pain and absence of tenderness. Motion was completely free and painless except for very slight discomfort at extreme hyperextension of the spine.

J. T. sustained severe low back pain in an automobile accident 7 days prior to admission. The spine was held rigid, forward flexion was very painful and almost completely restricted. There was bilateral lumbar tenderness and spasm. Straight leg raising was limited on both sides; tendon reflexes were physiological and there were no sensory changes. Diagnosis· Low back strain.

Marked relief of pain was obtained after 8 ultrasonic treatments to the paravertebral muscles. Motions were free with only slight subjective tightness in extreme positions. Straight leg raising returned to normal and there was no spasm or tenderness.

Of our 36 cases of low back strain treated by ultrasonics, 18 became completely or almost completely free of pain and 8 showed moderate relief. The other 10 failed to show significant changes. The average number of treatments was 9.4.

A comparable group of patients treated by thermotherapy, massage, and exercise, and picked at random from our files revealed the following results: With an average number of 9.8 treatments, 10 had complete or almost complete relief and 11 had moderate relief of pain. Statistically, it appears that ultrasonics was somewhat more effective in these conditions, but the difference is slight and not convincing. However, we feel that the interpretation is permissible that ultrasound is a therapeutic adjunct which has a certain pain relieving effect similar to that of other physical therapeutic agents. One of our cases whom we treated on three different occasions may well illustrate this point:

Patient A. H., with a history of surgical lumbo-sacral fusion and attacks of low back pain of many years' duration, had three admissions to our hospital. He responded symptomatically equally well to infrared and massage in 1948, shortwave diathermy, massage, and exercises in 1949, and ultrasonic therapy in 1950.

In 29 cases with low back pain and sciatic neuralgia due to herniated intervertebral disc, our clinical results were far less favorable. Only 4 cases were satisfactorily relieved and only 9 had moderate relief. Our control group of herniated discs treated with thermotherapy, massage, and exercise revealed an approximately equal result. The average number of treatments given was 8 for ultrasound and 13 for conventional therapy. These observations apparently suggest that all non-surgical procedures can not be expected to give satisfactory results.

Our observations on 4 traumatic cases showed also the analgesic effect of ultrasound without evidence of any other beneficial effect on traumatized tissue. The number of treatments, which depends entirely on the severity of the trauma, ranged from 2 to 20 with an average of 10. These results can be matched with any number of cases treated with other physical agents. One of our ultrasounded cases, however, may be noteworthy:

Patient A. F. sustained a fracture of the neck of the right humerus with complete tear of the supraspinatus tendon and the rotator cuff. Surgical repair followed by immobilization failed to restore the anatomical mechanism. Four weeks post-operatively a regimen of infrared and guarded active and passive exercises twice daily was initiated. After one month of unsuccessful treatment and continuous ache at the shoulder, one of the two infrared treatments was replaced by ultrasonic therapy. This change of treatment was followed by a gradual improvement and after 20 treatments the patient was practically completely relieved of pain. A functional improvement of the shoulder joint and an appreciable increase in joint range was neither expected nor obtained.

It is hardly conceivable that constitutional diseases such as rheumatoid arthritis can be cured or controlled by locally applied physical agents. However, stimulated by the report of Hintzelmann[5] and others we have treated by ultrasonic therapy 17 patients with Marie-Strumpell spondylitis and 3 patients with peripheral rheumatoid arthritis. Considerable or almost complete relief of pain was observed in 8 out of 17 cases of Marie-Strumpell's disease; 3 patients claimed moderate symptomatic relief of pain and 6 patients failed to respond. These latter cases were clinically and roentgenologically far advanced. In our control group of 17 cases of spondylitis treated with conventional therapy, the comparable figures were 7 completely or almost completely relieved, 2 moderately relieved and 8 failures. The average number of treatments was 14 and 18, respectively. In addition to having no evidence that ultrasound is of any greater benefit than other physical agents, it must be pointed out that the observed improvements were chiefly subjective relief of pain and that we could not confirm Hintzelmann's observations of clinically significant increases in mobility of the spine or improvement in chest expansion or vital capacity. The following case is an illustration of our observations on ultrasonic therapy applied to the back in rheumatoid arthritis:

Patient L. M., age 24, was previously admitted in 1948 for rheumatoid spondylitis of one year's duration. Under conservative treatment he experienced slight subjective improvement, but continued to have pain ever since his discharge in spite of continuous diathermy and aspirin. He was readmitted in June, 1951, with the following symptoms: Back pain when remaining in one position, aggravated by damp weather and motion; stiffness of spine and tightness of chest; pain and stiffness of knees. Physical examination revealed a vital capacity of 4400 cc. and a chest expansion of 1¾ inches. The cervical spine was freely movable, the dorsal and lumbar spine completely rigid. There were mild flexion contractures and capsular swelling of both knees and considerable muscular atrophy of both lower extremities.

Ultrasonic therapy to paravertebral muscles was initiated; patient was not placed on bed rest and no other treatment was given except that 4 grams of aspirin daily was continued through the first week of therapy. Patient received a total of 13 treatments. After only 2 treatments back pain was greatly diminished. After one week patient stated that back pain and tightness of chest had completely disappeared and at the end of the course of treatment the vital capacity had increased to 4900 cc. and the chest expansion to 2¼ inches. There was also some return of motion of the upper 4 dorsal vertebrae.

In peripheral rheumatoid arthritis, in which we treated symmetrical joints for control purposes, the pain relieving effect of ultrasound was not essentially different from that of other conventional physical agents; symptoms other than pain, such as swelling, contracture, and effusion, were not changed by the treatment.

The prognosis of degenerative and post-traumatic arthritis will, by the nature of the disease, depend upon the severity of the joint deformity. Since the degenerative changes are slowly progressing and pain is the main symptom, many forms of therapy will be beneficial. It is therefore not impressive that 6 out of 13 cases showed marked relief of pain following an average of 11 ultrasonic treatments. One case may be of interest because the reaction of both hips to different types of treatment were observed:

C. P., a 64 year old obese patient, was admitted with osteoarthritis of both hips. The left hip revealed a lack of 30 degrees of flexion and the absence of hyperextension and rotation. The right hip showed the same limitation except that a range of 15 degrees of internal rotation was present. The left hip, which by history and findings was considered the more involved one, was treated with ultrasound, while the right hip was treated with diathermy; active and passive exercises were given to both sides. In addition to, and probably because of, greater pain relief the left ultrasounded hip regained 20 degrees of flexion and 30 degrees of external rotation, while no increase of motion was obtained in the right hip.

Before concluding, some statement should be made regarding contraindications to ultrasonic therapy. According to Ungeheuer[13] and Buchtala,[23] sounding of the cervical ganglia or the heart can result in changes of the heart rhythm and should be avoided in cardiac patients. Sounding of the gravid uterus may induce abortion. Sounding of the gonads and the growing bone is likewise contraindicated. According to Henkel,[24] sounding of the eye may produce hemorrhages and detachment of the retina. It should be emphatically pointed out that the treatment of *malignant tumors by ultrasonics must* be considered contraindicated since the omission of proved treatments, such as surgical excision, roentgen and radium radiation, may endanger the life of the patient.

Conclusions and Summary

During the period from June, 1950, to June, 1951, 161 cases (141 patients) were given 1477 ultrasonic treatments. Because of the physical properties of ultrasonics the authors chose for their studies out of a vast variety of indications suggested in the literature such conditions as those in which heat and massage have always been considered beneficial. In order to evaluate the therapeutic results, an attempt was made to answer the following three questions: (1) Is there any damaging effect of ultrasound? (2) Is there any beneficial effect? and (3) Is the beneficial effect of ultrasound greater than that of other therapeutic agents? Since no significant detrimental effects were observed in 1477 applications, we believe that the answer to question (1) is a confirmation of the statements in the literature, namely, that ultrasonic therapy can be considered safe therapy. In order to answer questions (2) and (3), the observations made on our patient material were compared with those made on a similar group of control cases treated with conventional physical therapy. The findings suggest that ultrasonics has a pain relieving effect which apparently is equal to the analgesic effect of other physical agents such as infrared and diathermy. Some individual cases were discussed to illustrate these results. No claim could be made of any other curative effect, and ultrasonic therapy was considered local therapy which can not be expected to influence the etiological background of the conditions treated.

The chief advantage of ultrasonic therapy consists in its relatively easy application and the short duration (4-10 minutes) of the treatments. It has been our experience in the past that often a change from one physical agent to another will be followed by improvement in cases which previously failed to respond to therapy. From this point of view, ultrasonics is a welcome new therapeutic modality. However, we believe that many years of combined efforts in Physical Medicine will be needed to come to a final conclusion on the therapeutic possibilities of ultrasonics in medicine.

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[23] Buchtala, Viktor: Der Ultraschall in der Medizin, Schweiz. med. Wchnschr. 79:412, 1949.

[24] Henkel, K.: *Meine Erfahrungen mit Ultraschall zur Behandlung von Neuritis und Asthma,* Strahlentherapie 77:291, 1947.

Appreciation is expressed to the chiefs of Medical, Neuro-psychiatric, Paraplegic and Surgical Services of Cushing VA Hospital for their cooperation. These services, though not endorsing ultrasonic therapy as the only treatment to be used, permitted us to treat their patients with ultrasonics in order to make this investigation possible.

Discussion

Dr. W. A. Selle (Los Angeles, Calif.): Anyone acquainted with the literature on ultrasonics is aware of the impressive amount of research conducted in recent years on this new subject, and the imposing number of clinical reports which have appeared chiefly in foreign journals. It is apparent that interest in the therapeutic possibilities of ultrasound is increasing greatly in this country. It is also apparent that whereas the methods involved in the application of ultrasonic energy to patients are relatively simple, the interpretation of clinical results is not. It is further apparent that the employment of ultrasonic energy to patients by careless or unscrupulous users might cause harm and, in this respect, reflect unfavorably on physical medicine. Too many unqualified individuals are too often too quick to give an enthusiastic reception to a new and untried procedure. However, these criticisms are not unique to ultrasound. We all agree that some of the best physical agents have been condemned until their physiological and physical properties have been better understood and until safe measures of employment have been established.

May I digress at this point to state that medical papers are sometimes classified according to several categories. 1 — The provocative paper. This is the type with which one may disagree. 2 — The type which reports some basic new fact or principle. This is a type which obviously occurs only rarely. 3 — The type in which there is an authoritative correlation of established basic facts and a discussion of the application to man. This latter seems to be the category into which the paper of Dr. Friedland and colleagues falls, although it is admitted that it may also be of the provocative type.

The paper by Dr. Friedland and coworkers is a careful, objective, and critical evaluation of the clinical merits of ultrasound. The experiments recorded will influence many in deciding when, if ever, ultrasound should be used. A practical and important point brought out is that ultrasound is safe if applied under limits of recognized therapeutic dosages and in accordance with recognized contraindications. As with other effective therapy, serious injury can be produced if it is indiscriminately used. It is now evident that some of the injuries reported in the early literature were caused by intensities far above those considered safe for therpeutic purposes. To some it may be refreshing to find a paper which does not point with unabated enthusiasm to the wonders of ultrasound. To others it will be disturbing, for already a number of well qualified men in this country have used ultrasound and, in their judgement, with good results. The finding of Dr. Friedland and coworkers that ultrasound has no specific virtue and is no better therapeutically than other physical measures may not deter them and others from investigating for themselves the value of this relatively new agent. To the cautious, conscientious worker we would extend encouragement along these lines. For the impression is gained that even though Dr. Friedland and his group regard ultrasonics to be no better than other measures, the method is safe and deserves further study and application. In fact, a number of years of continued effort, particularly at large clinics, may be needed to evaluate the therapeutic possibilities of this new agent.

Dr. Aldes of Cedars of Lebanon Hospital in Los Angeles tells me that on a limited number of geriatic patients, mostly arthritics, his results are good. Dr. Rosenthal, too, has reported excellent results with ultrasound therapy as has Dr. Bettman of the Hospital for Joint Diseases in New York City, to mention only a few in this country who feel that ultrasound energy has therapeutic merit. There are also British investigators who report encouraging results although they indicate that it is too soon to make a final evaluation of this therapy. To those who are already using ultrasound and to those who may use it later, we would like to stress Dr. Friedland's statement concerning the evaluation of results. I quote, "The conditions which are considered to be most suitable for ultrasonic therapy are either self-limited, respond to a great number of therapeutic measures, or are of such a nature that they may go into a state of remission without the possibility of predicting such an event. In many of these conditions, the change of environment and the limitation of daily activities brought on by hospitalization have a therapeutic value which alone can influence the course of events." To these complicating factors we might add the psychological factors and the difficulty frequently encountered in arriving at an accurate clinical diagnosis. In other words, the establishment of adequate controls is difficult. The authors do not attempt to explain the effect of sound treatment and it is well perhaps they do not, for others who have tried to do so usually invoke a complex hypothesis. It must be left to fundamental biological studies to determine whether the reported physiological effects of ultrasound are predominantly mechanical, thermal, or chemical. In your conclusions, Dr. Friedland, you state, and I quote, "There is no evidence of any specific effect of ultrasound. No claim could be made of any other causative or curative effect and ultrasound therapy was considered local therapy which cannot be expected to influence the etiological background of the condition treated." I wonder if you would augment this statement a little. Since your preliminary investigations show that ultrasound is equal in effectiveness to diathermy and infrared in certain conditions, would you therefore say that these other modalities do not influence the background of the condition treated? Lastly, in the event that ultrasound proves to be no better than diathermy, do you feel that hospitals and clinics are justified in purchasing another equally good but no better therapeutic device?

Papers such as these are timely. They have definitely increased our knowledge in the field of experimental and therapeutic ultrasonics. I feel certain that they will be a stimulus to others in this country to report studies which may broaden our horizon relative to the possibilities of this new physical agent.

THE REPETIMETER *

Report of a New Clinical Instrument

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If physical activity is to be therapeutically effective, a specified dosage of certain components of the activity is necessary. Prescribed specification of such qualities as intensity of contraction, rate of performance and range of motion, provides the therapist with criteria to carry out the proper treatment. Intensity of contraction can be regulated by setting a specific work load. This can be done by the therapist manually, as in muscle reeducation, or mechanically by such means as varying weights, spring tension, or friction adjustment on various devices. To assure that the rate of performance and range of motion are carried out as prescribed, the constant attention of the therapist usually is required: the patient may speed up the activity to get it over with,[1] or may diminish his efforts by tapering off the range of motion during the exercise period, thereby making the results of his exercise less effectual. By use of a regulating device, we are attempting to make exercise more effective by preventing such "cheating."

The Repetimeter

It has been shown that work during exercise is a function of energy and time.[2] Energy expenditure during exercise can be regulated simply by adjusting the work load. It has been suggested that the time factor be regulated by following a rhythmic regulating device such as a metronome. Also, definite working limits have been recommended for increasing range of motion of an affected part. It is recognized that coordination should improve when an attempted movement is thus repeatedly performed to a definite standard, while strength and endurance should develop if enough work is repeatedly performed a minimum number of times.[3-4] We are attempting to regulate working time without the patient's having to fall into step with a rhythmic device, and the same time to regulate the range of motion.

A new therapeutic clinical instrument, named the Repetimeter, has been developed to provide a means of assuring an adequate exercise performance rate, a proper number of exercise movements during each treatment period and a specified range of movement accurately reproduced with each repetition. This device has been found to have wide utility in various fields of Physical Medicine, providing a precise means of regulating exercise activity. Repetimetry has been found to be clinically useful in active exercise, progressive resistance exercise, isometric contraction, breathing exercise, underwater exercise, and in specific movements in occupational therapy. It can be used along with electrical stimulation of muscles or nerves and in the performance of certain types of passive exercise.

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* Reviewed in tl [illegible] l published with the approval of the Chief Medical Director. The stateme [illegible] by the author are the result of his own study and do not necessarily re [illegible] the Veterans Administration.

* Read at the T [illegible] f the American Congress of Physical Medicine, Denver, Colorado, September 6, 1951.

1. Kraus, H.: Principles and Practice of Therapeutic Exercise, Ed. 1, Springfield, Ill. Chas C Thomas, 1949.
2. Licht, S.: Occupational Therapy 24:167 (June) 1947.
3. DeLorme, T.: Arch. Phy. Med. 27:607 (Oct.) 1946.
4. Kraus, H.: Arch. Phy. Ther. 24:151 (March) 1943.

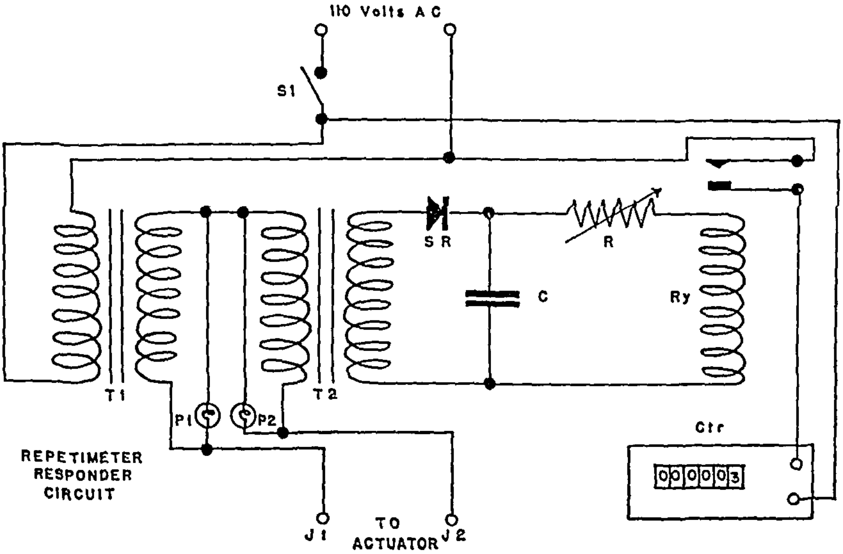

Fig. 1. — Repetimeter Responder Circuit: S1 — on-off switch; T1 — step-down transformer (20:1); T2 — step-up transformer (1:20); J1, J2 — operating terminals; P1 — pilot light; P2 — operation indicator light; R — rectifier; C — condenser; *R — variable resistor; Ry — relay; Ctr. — counter.*

After several Repetimeters had been constructed and found to be clinically effective, very little could be found in the literature concerning similar devices. Undoubtedly mechanical counters have been used in physical activity. A report in 1946 described the use of a simple pulley arrangement and a mechanical counter attached to the foot of a hospital bed to assure patients' exercising their leg muscles to prevent venous thrombosis.[5] During the past year we have used a mechanical counter attached to wall pulley exercise apparatus. Counters such as these are useful but limited in their clinical applications. The Repetimeter, however, not only records the *quantity* of activity but is able to control its *quality,* regulating the rate of performance, range of motion and the number of exercise repetitions.

Principles and Operation

The Repetimeter consists of a Responder unit operated by various types of Actuators. The Repetimeter Responder is an electrically operated instrument which automatically registers the number of exercise repetitions on a resettable counter. It is more than a simple counting device; a counter merely serves as an indicator. The Responder provides a means of setting the performance rate to prevent "speed-up" during exercise.

The Responder can be actuated by a variety of means in response to physical activity. Actuation can be effected at any desired position of a part of the body and at no faster than a desired rate. It can be effected directly by movement of the body, or indirectly by movement of a piece of apparatus operated by the body.

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[5] Narat, J. K., and Cipolla, A. F.. Arch. Surg. 53:345 (Sept) 1946

By utilizing various types of Actuators, the Repetimeter can be made to perform in many different situations. It can regulate active exercise in free space. It can be used to assure adequate muscle setting, even inside a plaster cast. It can regulate exercise underwater in a whirlpool bath. It can regulate activity using exercise apparatus, such as the stationary bicycle, rowing machine, or shoulder wheel. It can regulate arm and leg activity of a patient using occupational therapy equipment, such as looms, bicycle jigsaws and treadle devices. It can be used to register the number of electrical stimulations given during a treatment period. It can be used for breathing exercise to assure proper limits of respiration and an adequate amount of exercise. It can be used to help regulate the range of motion in passive exercise.

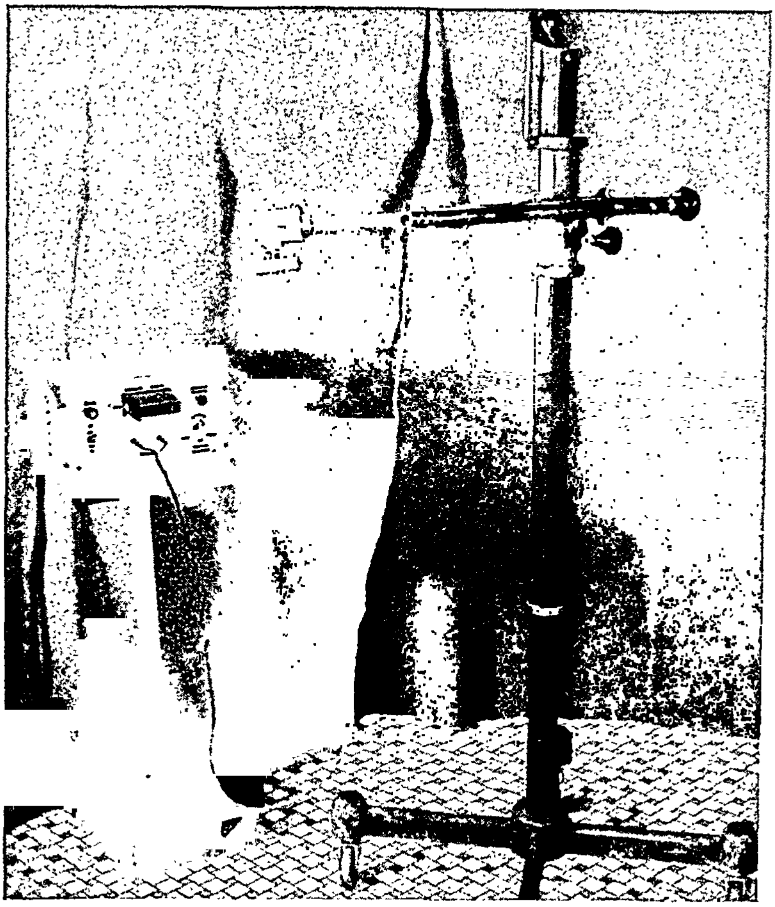

Fig. 2. — Contact Actuator on adjustable stand, connected to Responder Unit, at left.

Repetimetry provides a means of accurately prescribing the quality and quantity of exercise. As an example, the following prescription would ordinarily require a therapist's full time for over 30 minutes:

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Active flexion, right elbow, to 110 degrees, 600 times at 20 Rp./min.

Using the Repetimeter, the therapist is not only assured that the prescription will be accurately carried out but will be free to give other treatments during this period. The number of patients able to receive exercise treatments simultaneously under the supervision of one therapist is thus effectively increased.

The response of patients to Repetimetry is worth mentioning. A patient who is able to see something tangible occurring on each movement is provided with an objective. He is made to realize that something definite is expected of his performance and can thus become an active participant in the task of doing the job properly. Besides showing a more sustained interest in what is ordinarily a monotonous activity, patients frequently remark when using the Repetimeter that they cannot "cheat" by rushing or tapering-off their efforts.

Description

The Repetimeter Responder Unit is built into a metal cabinet mounted on a movable stand so that it can easily be transported where needed. It receives its power from the 110 V., A. C. line. It consists of a keyed low voltage circuit operating an electromagnetic resettable counter through an adjustable time delay circuit (Fig. 1).

Various types of Actuators can plug into the input terminals. Such Actuators are basically switching arrangements to close the keyed circuit of the Repetimeter Responder. Actuators can be made to operate by any physical means, such as response to contact, position in space, proximity, passage of an electrical current, or interruption of a light beam. Various Actuators and techniques have been devised and put into clinical use. Those to be described have been found to be entirely practical and useful.

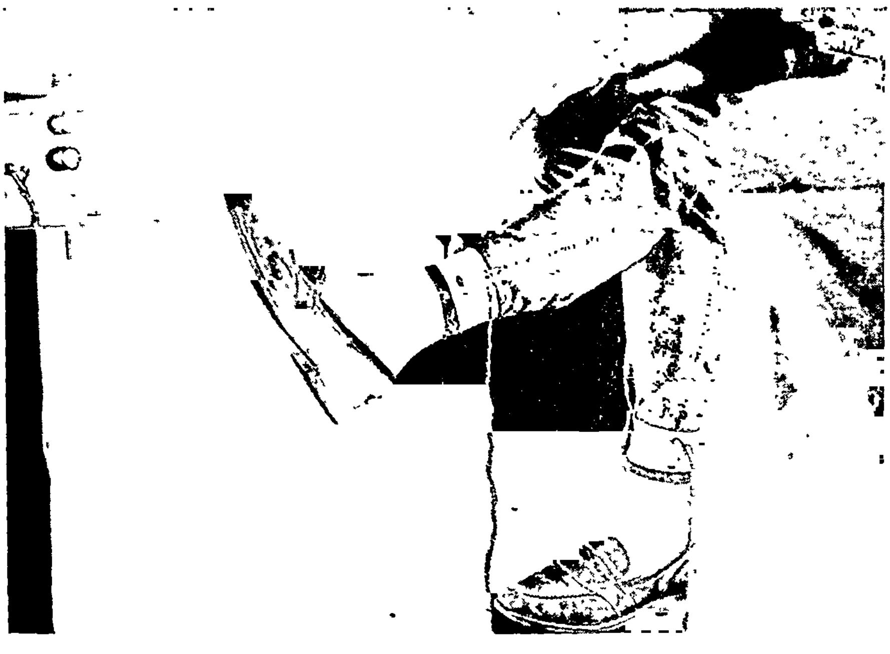

Fig. 3. — Quadriceps extension regulated by mercury switch mounted on cuff.

Techniques of Actuation

Cuff Techniques. — A set of leather cuffs with adjustable straps has been constructed to fit various parts of the body (Fig. 3). Each cuff has attached to it a small rotatable sleeve into which fits a tubular mercury switch. This switch operates by the action of gravity on a globule of mercury which closes a set of contacts at one end of the tube when it is tilted below a horizontal position. By positioning the long axis of the switch parallel to the plane of body movement to be regulated, and by rotating the sleeve upon the cuff to a desired angle, a critical operating limit can be set. The Repetimeter Responder Unit is provided with an operation indicator light to facilitate setting this angle before movement begins. After setting the angle, the desired time delay is set and, from then on, each exercise repetition registers sequentially on the counter. Failure to repeat the full movement, or speeding up of the activity results in loss of count until these conditions are corrected. Once the patient realizes that he must perform the exercise precisely to receive an additive count, he tends to correct these errors himself.

Contact Switch Techniques — For contact operation, a sensitive single pole normally open contact switch is used. The switch requires only a few ounces of operating pressure A very useful Actuator for the clinic is a metal-enclosed switch mounted on a movable adjustable stand (Fig. 2). A lamp stand was adapted by mounting the switch at the end of a horizontal arm The switch can be adjusted and locked in position vertically, horizontally or swiveling to either side Locking casters serve to keep the stand from moving during use.

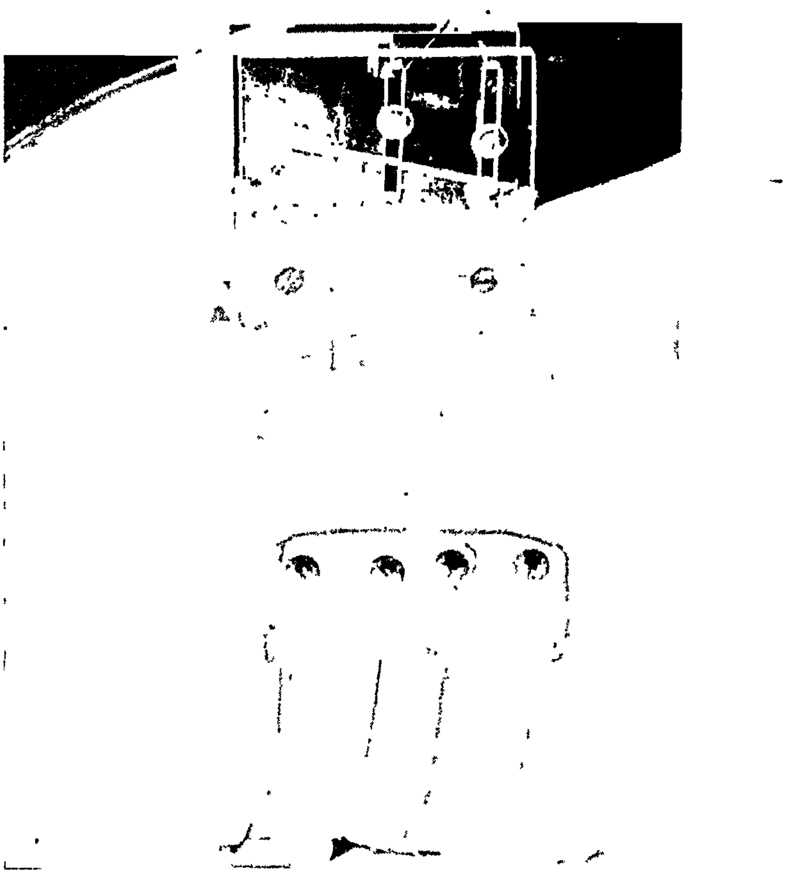

Fig 4 — Quadriceps setting inside plaster cast regulated by portable contact Actuator

(a) *Active Exercise in Free Space* — The contact switch is provided with a 2-inch diameter plastic pressure plate attachment. This allows a larger contact area and is useful when the patient is to do active exercise. The part of the body is positioned in space to a desired limiting angle using a goniometer if desired. The pressure plate of the switch is then positioned and adjusted so that contact with it is just made at the limiting angle, as noted by the operation indicator light. Time delay is then set and exercise proceeds for the desired number of repetitions.

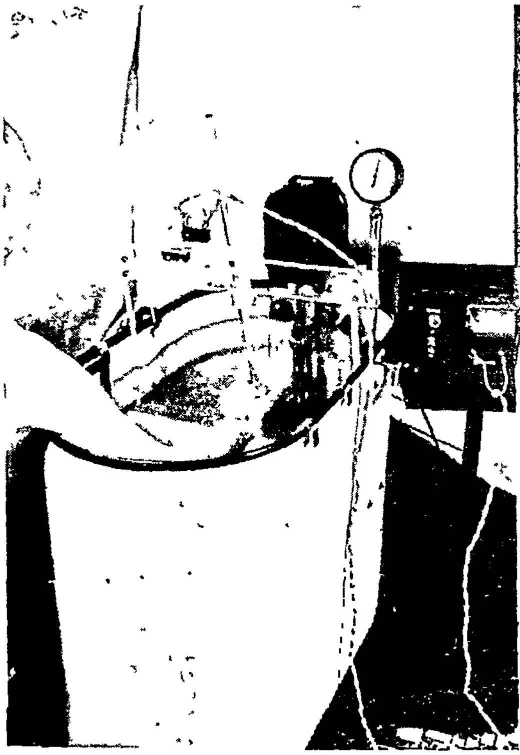

Fig. 5 — Underwater extension of wrist regulated by contact actuation

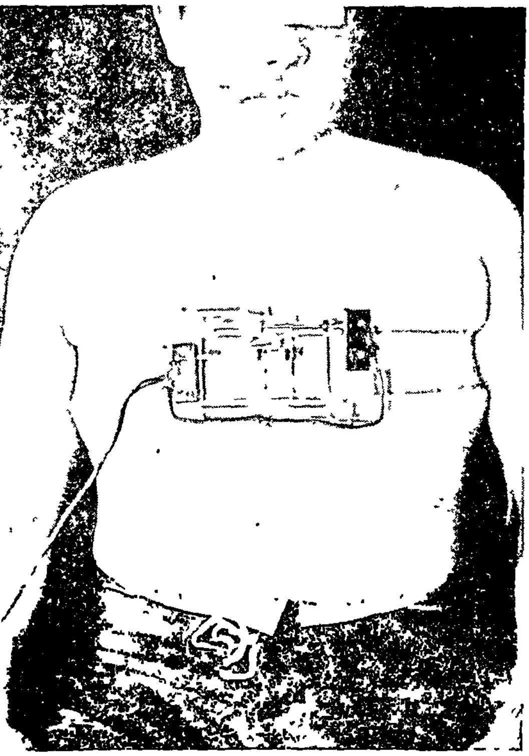

Fig 6 — Deep inspiration regulated by contact actuation

(b) *Use in Muscle Setting* — The plunger of the switch is a short rod, which can be operated directly by contact with the body. By inserting this plunger through a small hole cut into a plaster cast and establishing contact with the belly of a muscle, isometric contraction which produces a minute rise in the muscle belly can be made to actuate the switch. If the cast is very thick, a plastic extension rod is attached to the plunger.

For ward use, a portable Actuator for muscle setting has been devised (Fig. 4). A plastic assembly holds a sensitive switch firmly in relation to a plaster cast, while a movable rod transmits the motion of the muscle through a hole to the switch. This device has been of value in educating patients to do muscle setting properly and by requiring a definite number of contractions, it has assured an adequate amount of exercise throughout the day. Previously, one could not be sure whether a patient was actually exercising inside a cast A patient might demonstrate to the therapist that he was able to perform muscle setting and then fail to carry out the exercise. Repetimetry serves to overcome this difficulty

(c) *Underwater Exercise* — Up to the present, there has been no way of knowing whether active underwater exercise is being properly performed. For this purpose, an Actuator constructed of acrylic plastic has been devised (Fig. 5). A contact plate on the end of a rod can be positioned under the water so that actuation can be accomplished at any desired limit of movement. By means of two switches, either upward or downward movement causes actuation.

(d) *Use in Breathing Exercise* — A special Actuator for breathing exercise has been devised (Fig. 6). An expansible belt is fastened snugly around the body. Chest or abdominal movement is transmitted to two switches with the device so adjusted that actuation can be made at any limit during inspiration or expiration. Increasing limits of expansion can be set as required. Actuation on inspiration may be used in general deep breathing exercise, while expiratory actuation may be useful in asthmatic breathing exercise.

(e) *Use in Electrical Stimulation.* — When using electrical stimulation for treatment, it is sometimes desirable to know how many contractions have been given. By passing the stimulating current through a rectifier, a sensitive relay is made to close, thereby actuating the Repetimeter Responder. The insertion of the rectifier into the stimulator circuit reduces the output of the stimulator very slightly and this can be compensated for by setting the current intensity control slightly higher than usual.

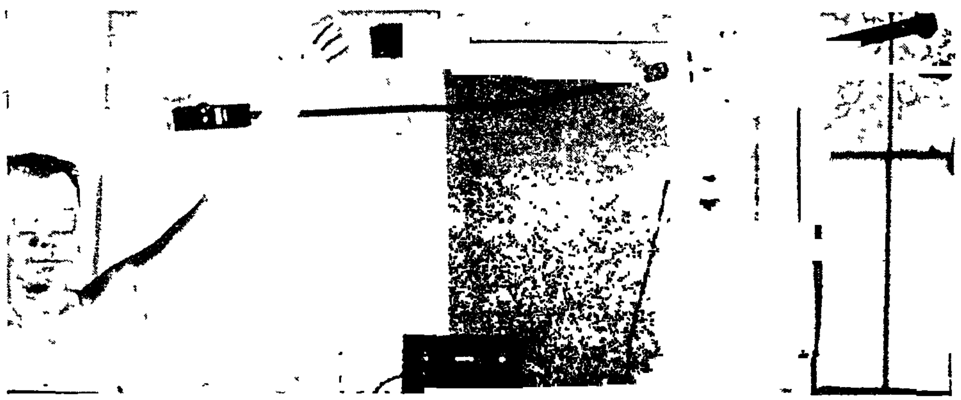

Fig. 7. — Shoulder abduction regulated by photoelectric actuation.

(f) *Photoelectric Actuation.* — We have devised a photoelectric cell and light beam arrangement mounted on an adjustable stand to allow Repetimetry without the need for mechanical contact with the patient (Fig. 7).

This type of actuation has been found to be convenient and especially useful for regulating large movements of the trunk and extremities, but it can be utilized for many movements, small and large, wherever the beam can be conveniently positioned.

Clinical Use

Eighteen months of clinical trial have shown Repetimetry to be useful in a wide variety of clinical applications. By providing the physiatrist, the therapist and the patient with objective criteria for exercise performance, tangible goals can be set resulting in improved performance.

The physiatrist is able to prescribe a definite dosage for certain activities and is assured that they will be carried out as specified. As conditions change, he can increase the limits of range of motion, as well as the amount of exercise. In prescribing progressive resistance exercise he is assured that the performance of each repetition-maximum series will be based on an accurate performance of the same range of motion without tapering off.

Therapists have readily adopted Repetimetry in their work. Previously many active exercise procedures required constant attention to one patient. They are now able to set up a group of patients simultaneously on exercise activity and then proceed with other treatments, informed by the tick of the Repetimeter Responders that each patient of the exercise group is properly performing his task. A brief occasional check is usually all that is needed throughout the treatment period.

Active underwater exercise is often improved by use of the Repetimeter to regulate exercise in the whirlpool bath. Patients have generally shown better progress because of their more active participation and more precise performance when Repetimetry has been used.

Progressive resistance exercise can be improved by use of the Repetimeter, since the same range of motion must be reproduced with each exercise repetition. Seeing a patient "squeezing out" the last few degrees of movement on every repetition effectively demonstrates how much more precisely the Repetimeter is able to regulate the performance of this type of activity than any therapist alone can do.

When a specific functional movement is desired in Occupational Therapy, exercise apparatus, such as looms and treadle or bicycle action devices, have been found to be readily adaptable for regulation by Repetimetry.

From experience with certain cases of muscular weakness, it is believed that Repetimetry may be of value in the treatment of poliomyelitis when muscle strength has improved to the stage where movement can be performed by the patient himself without support.

While Repetimetry has demonstrated its value in a variety of applications, its possibilities are not limited to the application here described and new applications will probably develop if this method comes into use.

Summary

1. A new clinical instrument, the Repetimeter, has been devised to regulate therapeutic exercise.

2. Principles of operation, methods of actuation and clinical applications are described.

3. Preliminary clinical experience has shown the Repetimeter to be useful in conjunction with many established procedures in Physical Medicine.

Discussion

Dr. Louis P. Biro (Los Angeles, California): The importance of a thorough knowledge of physics has been emphasized by many leaders of Physical Medicine. This was well recognized by the Baruch Committee in their recommendations as outlined in their report in 1945. Exact measurement is the fundamental of a science. Science is measurement. The present status of Physical Medicine has been possible only through the application of the principles of physics. Without the development and technical perfection of diagnostic and therapeutic instruments of a high degree of precision, Physical Medicine as we know it today, would be impossible.

While it is true that much can be accomplished in Physical Medicine with very simple equipment, more specialized instruments both for diagnostic and therapeutic purposes have become essential for further progress.

Many refinements in the study of research problems were made possible by applied physics, and the many instruments provided by physics. Many examples of such instruments may be cited — such as the ergograph, goniometer, pressure gauges, electromagnetic flow meter, electromyograph. These play important parts in the solution of research problems. The cooperation of the clinician, the physicist and the engineer, in providing suitable and necessary instrumentation, is producing impressive results. The paper just presented by Dr. Schlesinger is an outstanding example of this cooperative effort, only in this case all three of these fields have been combined in one.

The clear cut descriptions and illustrations of Dr. Schlesinger hardly leave anything for the discussor. This work represents an important step toward placing exercise on a more scientific basis. The value of exercise in the full rehabilitation of the patient is well recognized. Among the many virtues of the Repetimeter as described by Dr. Schlesinger, I would like to emphasize just two features which appear to be of particular interest — first, the physician prescribing exercise can be assured the exact prescribed movement will be carried out by the patient; secondly, the psychological effect upon the patient undoubtedly will result in improved performance. One of the difficulties most of us experience when trying to carry out a prescribed exercise program, is the rapid loss of interest (on the part of the patient) in an activity which soon becomes monotonous, and for this reason requires the constant supervision of the technician. The use of the Repetimeter focuses the interest of the patient on watching his performance record and relieves the technician from the necessity of constant supervision, thus freeing her for other duties. This feature should appeal to all those who have been troubled by shortage in technical help.

Finally, I am glad to see Dr. Schlesinger join that select group of our members, represented by men like Drs. Bierman, Paul, Louis Newman, Schenker, Worley Kendell and others, whose work in developing many useful diagnostic and therapeutic instruments has contributed so much to the impressive progress of Physical Medicine and Rehabilitation.

Dr. S. Mead (St. Louis, Missouri): I have had the opportunity of visiting in Dr. Schlesinger's clinic and of seeing his device in operation.

Briefly, I would like to say that it has impressed me because of its apparent usefulness (to mention just one good example) in making quantitative evaluations of isotonic motion.

As you know, most strength tests which have been worked out for repeatability for the coefficient of reliability have gradually boiled down to isometric tests because of certain factors which make isotonic tests rather unreliable. Nevertheless, functionally we actually use isotonic motion for the most part, not isometric.

We wanted to use it in RM determination in progressive resistance exercise as a quantitative measure of the patient's progress, and we did use it in a rather rough clinical experiment. For more refined techniques we have recognized that we could not use this because the patient never came to the same degree of extension, for example, of the knee, nor did he follow the proper rhythm unless very carefully timed.

With the aid of a device of this kind the patient is forced to carry out full extension each time, or whatever other motion might be involved. In addition to that, he cannot rush the exercise. The time constant of the device makes it impossible for him to use pendular motion or cheat or substitute in other ways.

Therefore, to mention just one example of an application, the device commends itself to me for the reasons explained by Dr. Schlesinger.

RESOLUTION APPROVED

The report of the Council on Medical Education and Hospitals of the American Medical Association was approved by the Advisory Board of Medical Specialties at its business meeting on February 10, 1952. Included in this report was the following Resolution:

"Whereas, An emergency medical call service is of proven value both as a community public service and as a means of good public relations between a physician and his community; and

'Whereas, Participation in such a service is not onerous if many physicians cooperate; and

"Whereas, Every County Medical Society has been asked to operate such an emergency service; therefore be it

"Resolved, That every doctor below the age of 35 years, regardless of his type of practice, be urged to participate in his community's call plans; and be it further

"Resolved, That all national specialty boards be requested by the Secretary of the American Medical Association to facilitate such general participation by assuring their members and potential members that they may participate in such a community activity without jeopardy to specialty ratings.

"Amendment —

"Resolved, That all national specialty boards be requested by the American Medical Association to facilitate such general participation by assuring their members and potential members that they may participate in such a community activity without jeopardy to specialty ratings."

EDUCATIONAL THERAPY IN THE VETERANS ADMINISTRATION REHABILITATION PROGRAM *

LOUIS B. NEWMAN, M.E., M.D.
Chief, Physical Medicine and Rehabilitation Service
and
IRVING R. POPELL, M.A.
Chief, Educational Therapy Section

VETERANS ADMINISTRATION HOSPITAL, HINES, ILLINOIS

This paper is a description of Educational Therapy as instituted in the Veterans Administration, and more specifically, at the Veterans Administration Hospital, Hines, Illinois, as part of Physical Medicine and Rehabilitation.

John Ruskin, the English author, social reformer, and art critic, stated in his book, Stones of Venice,[1] that "Education is the leading of human souls to what is best, and making what is best out of them." Educational Therapy, as part of Physical Medicine and Rehabilitation in the Veterans Administration, plays an important role in the rehabilitation of the sick and disabled. Educational Therapy is defined in the Veterans Administration Technical Bulletin[2] as the use of educational courses medically prescribed as therapy for patients to help restore them to fullest mental and physical capacity commensurate with their abilities. Much can be done toward the patient's total rehabilitation while he is hospitalized.

The Educational Therapy Program at the Veterans Administration Hospital. Hines, Illinois, was inaugurated in March, 1946, and is under the close medical guidance and supervision of the physiatrist. In conjunction with the ward physician, the physiatrist specifies whether the patient is to receive his therapy while in bed or in the clinic; how much time is to be spent sitting and/or standing; the exact position of the patient's extremities and how they are to be used; also the length of time the patient may spend in Educational Therapy daily. The therapist must also be watchful for signs of fatigue or other untoward reactions on the part of the patient. This is extremely important so that the patient secure maximum benefit not only insofar as function is concerned but also with regard to the building of work capacity. His progress is reviewed frequently by the physiatrist and the therapist both as to the educational advancement being made and also as to physical and psychological adjustment. Detailed written progress notes are kept by the therapist in the patient's Physical Medicine and Rehabilitation folder. As soon as he has received maximum hospital benefits and rehabilitation, the patient is discharged from the hospital even though he may not have completed his prescribed course in Educational Therapy. This unfinished study can be completed at school or by correspondence courses taken at home.

In order to rehabilitate the disabled veteran, Educational Therapy offers purposeful educational activities which help to provide motivation for further rehabilitation, measure and develop work capacity, develop occupational skills,

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* Published with the approval of the Chief Medical Director, Veterans Administration. The statements and conclusions published by the authors are a result of their own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

* Read at the Twenty-Ninth Annual Session of the American Congress of Physical Medicine, Denver, Colorado, September 6, 1951.

1. Ruskin, John: "Stones of Venice." Vol. 3, London, Smith, Elder & Company, 1853.

2. "Educational Therapy for Patients in VA Hospitals." Veterans Administration Technical Bulletin 10A-116, February 2, 1948.

raise the educational level of the patient, build self-confidence, and develop socially desirable habits and attitudes, all of which should aim to make him a more dynamic and useful citizen. The significance of these general objectives will depend upon the individual's requirements. Let us analyze each of these to see how Educational Therapy aids the patient.

By providing practical courses, Educational Therapy motivates the patient and promotes new interests, contributing to his recovery and eventual return to community life. The effectiveness of this therapy depends upon the adequate stimulation of the patient. If properly motivated he tends to be co-operative during his hospitalization and he is more likely to remain hospitalized until maximum recovery is achieved. This is an especially important factor in the treatment of the tuberculous patient.[3] Since the successful completion of a course of study may frequently be one of the first indications to the patient that he can still accomplish worthwhile results, Educational Therapy is often a strong factor in building morale. The proper type of educational course helps to minimize both the mental and physical deconditioning and deterioration which often accompany severe and/or extended illness. In addition, the patient's participation in Educational Therapy during hospitalization encourages him to continue his education following discharge.

Educational Therapy can be used effectively to measure and develop work capacity.[4] It can thus help the physician and the therapist evaluate the patient's work capacity and determine whether the patient who plans to continue his education after discharge from the hospital actually has the physical capacity required of student life, and later, of his job. This evaluation is accomplished through planned educational activities beginning, if indicated, at the bedside and advancing to treatment in the educational clinic as soon as medically feasible. In this manner, controlled conditions are arranged at the hospital similar to those encountered at school.

Increasing work capacity is especially important for tuberculous patients. Here, Educational Therapy often is extremely helpful, inasmuch as it is started early in the patient's period of hospitalization, and may be presented in a graded series to conform to the patient's physical and mental ability.[3] The patient's work capacity may be evaluated by observing the effect of measured increases in the type and amount of his total hospital participation in physical medicine and rehabilitation, self-care, and vocational and recreational activities. By participating in Educational Therapy the patient gains an excellent appreciation of his capabilities in relation to his occupational plans. Frequently, this therapy is prescribed to supplement the treatment the patient receives in the other Physical Medicine and Rehabilitation procedures.

Educational Therapy may also be used to improve muscle action and coordination for patients with impaired function, as in spinal cord injuries, arthritis, amputations, hemiplegias, and other neurologic and orthopedic conditions. Examples are handwriting, typewriting, and the use of various office machines by quadriplegia, hemiplegia, and arthritic patients. Figure 1 shows a 29-year-old patient with rheumatoid arthritis, typewriting. In addition to providing a useful office skill, this type of therapy definitely improved the function of his severely-involved hands by increasing range of motion, muscle strength, and coordination. This patient has since returned to his retail dry goods establishment.

Educational Therapy can be extremely valuable to the disabled veteran by offering him the opportunity of exploring new fields of work in order to develop occupational skills. This is definitely significant in the case of patients who never were gainfully employed before hospitalization, those who must change their occupation because of their disability, and those who hope to advance themselves on their jobs to which they will return after hospitalization. The veteran who never was gainfully employed prior to hospitalization has an excellent opportunity during his hospital stay to explore new fields of interest. Interviews and tests administered by the vocational adviser and correlated with those of the educational therapist enable the patient to pursue educational courses which will be valuable for a specific occupation.

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[3] "The Role of Physical Medicine in the Treatment of Tuberculous Patients." Veterans Administration Technical Bulletin 10A-148, July 12, 1948.

[4] Newman, Louis B: "Rehabilitation of the Tuberculous Patient in the Veterans Administration." Proceedings of the First Annual Tuberculosis Rehabilitation Conference, Tuberculosis Institute of Chicago and Cook County, Chicago, Illinois, February 25, 1950.

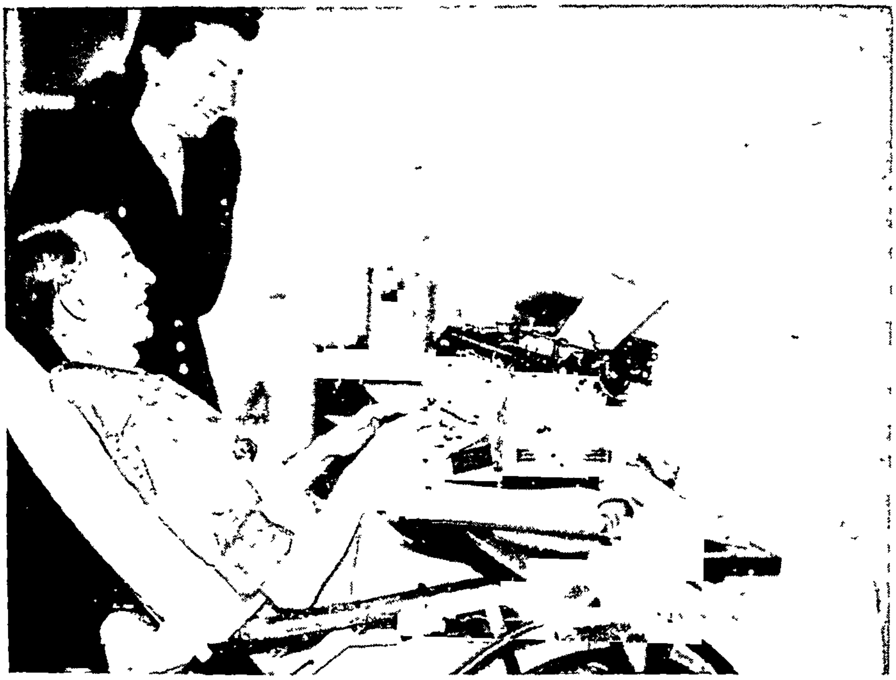

Fig. 1. — Patient with rheumatoid arthritis resulting in severe involvement of the back as well as both upper and lower extremities, operating the typewriter.

For example, if the patient plans to do office work, courses in typewriting, shorthand, bookkeeping, and the operation of modern office machines are available.

The patient whose disability will not permit him to return to his former position involving physical activity beyond his ability and capacity will find that educational courses will prepare him for office work or other sedentary occupations. An excellent example is the case of a 47-year-old white male patient at the Veterans Administration Hospital, Hines, Illinois, who before hospitalization was employed for many years as a clerk handling packages in the parcel post section of the post office. His inability to stand and perform moderately heavy work for periods over a half hour prevented return to this position. While receiving definitive medical care and rehabilitation at this hospital, this patient completed a course in typewriting, enabling him to be employed as a clerk-typist at the same post office.

Educational study is extremely valuable to the patient who desires to advance himself on his old job after he leaves the hospital. For example, the patient who obtains his high school diploma during his hospitalization may thus become eligible for promotion after returning to work. The clerk-typist who learns bookkeeping or shorthand makes himself more valuable to his employer, thus increasing his chances for promotion.

Educational courses are helpful in still other respects. Some courses have a practical value for the patient's occupation. A review course in arithmetic may be extremely useful to sales people and office workers. Mathematics is also particularly helpful to timekeepers, radio repairmen, carpenters, and bank personnel. The study of English is beneficial in practically all occupations. The ability to speak, read, and write a foreign language is required in certain vocations, and is desirable for patients planning to travel or work in foreign countries. Furthermore, many patients pursue English, mathematics, foreign language, and other subjects purely for self-improvement and educational advancement. Nothing is lost in advancing one's education; in many instances it helps make a complex social problem a simpler one.

Educational therapists in the Veterans Administration must meet educational and experience requirements. The educational requirement is four years of academic study completed in an accredited college, university, or teacher training institution, including at least twelve semester hours in education. The experience qualification specifies that the applicant must have at least one year of experience.

Since the inception of the Educational Therapy Program at Hines, a plan of continuous in-service training under the direction of the physiatrist has been instituted in order to keep the staff abreast of modern trends and developments in education particularly as to its role in physical medicine and rehabilitation. This training consists of selected films, lectures, and clinical conferences. An excellent library of professional books and magazines is available at the hospital.

The educational therapist at Hines is an important member of the Rehabilitation Board,[5] which consists of the physiatrist, who is the Chief, Physical Medicine and Rehabilitation Service, as chairman; the patient's physician; the psychiatrist and psychologist; physical therapist; occupational therapist; corrective therapist; manual arts therapist; vocational adviser; social service worker; nurse; dietitian; recreational technician; and the contact representative. The purpose of this board is to plan, inaugurate, and evaluate the rehabilitation program for each patient referred for consideration; to focus the maximum benefits of all hospital services upon the patient in order to facilitate his rehabilitation; and to correlate the rehabilitation program of the patient with his post-hospital plans.

The educational therapist correlates his treatment with that of the other therapists, especially with the vocational adviser, so that the specific rehabilitation program of the patient is co-ordinated with his post-hospital objective. Information received from the vocational adviser concerning the interests, ability, and aptitudes of the patient is highly valuable to the educational therapist; likewise, information received from the therapist relative to the patient's interest, learning ability, attitudes, and progress in his course of study is helpful to the vocational adviser.

The educational therapist recommends to the vocational adviser and psychologist, patients who desire or are participating in Educational Therapy and who will profit from the advisement and guidance program regarding questions such as the measurement of interests in different occupational fields, analysis of aptitudes, survey of employment and employment training opportunities, and the selection of a career. The vocational adviser recommends to Educational Therapy patients needing remedial instruction in particular subjects such as reading, English, and mathematics; those desiring to complete or continue their elementary, high school, or college education during hospitalization;

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[5] "Establishment of Rehabilitation Boards in VA General Medical and Surgical Hospitals and Tuberculosis Hospitals." Veterans Administration Technical Bulletin 10A-13, December 26, 1946.

	GRADE SCHOOL		HIGH SCHOOL								COLLEGE							
	1 - 8 years		1 year		2 years		3 years		4 years		1 year		2 years		3 years		4 years and up	
Enlisted Men	Number	Per-Cent	Number	Per-Cent	Number	Per-Cent	Number	Per-Cent	Number	Per-Cent	Number	Per-Cent	Number	Per-Cent	Number	Per-Cent	Number	Per-Cent
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
7,914,602 100%	2,389,961	30.2	652,653	8.2	909,677	11.5	910,072	11.5	1,898,629	24.0	455,070	5.8	289,884	3.7	145,309	1.8	263,347	3.3

[1] Does not include illiterates

Fig. 2. — Distribution of enlisted men in the Armed Forces, January, 1944, by years of education.

those who need to explore various fields of work; and those who desire to develop specific occupational skills such as bookkeeping and accounting. The individual's physical and mental capacities should be matched with the physical and mental demands of the job.

Through Educational Therapy the hospitalized veteran has the opportunity of raising his educational level. The U. S. Office of Education[6] of the Federal Security Agency compiled statistics concerning the educational level of a sampling of 7,914,602 enlisted men in the Armed Forces as of January, 1944. This does not include illiterates. Figure 2 shows that of the total 7,914,602 men, only 30.2 per cent attended elementary school, completing grades ranging from one to a maximum of eight. Of the same total, 7,914,602 men, only 24.0 per cent were high school graduates. Furthermore, of this total number, only 3.3 per cent had been graduated from college or completed some graduate study. The statistics regarding the educational background of hospitalized veterans at Hines present a similar picture of limited and incomplete education. These figures strongly emphasize the necessity and significance of Educational Therapy in its objective of helping patients raise their educational level. In the five-year period from March 1, 1946, to July 1, 1951, 2,567 patients at this hospital have had Educational Therapy prescribed as a part of their total rehabilitation. Of this number approximately 92 per cent were veterans of World War II, the need and indications for this type of therapy being much greater in the younger individual.

Patients at Hines may earn elementary diplomas by completing studies and achievement tests at the hospital under the supervision of the Educational Therapy Staff. The diplomas are awarded by the Maywood, Illinois, Public Schools. In the three-year period from March 1, 1948, to July 1, 1951, twenty-three patients received their elementary diplomas while at the hospital.

Patients may also receive high school diplomas or certificates from their home-town high schools by completing courses and the General Educational Development tests at the hospital under the supervision of the Educational Therapy Staff. In this manner, 350 patients have been awarded diplomas in the five years from March 1, 1946, to July 1, 1951.

By special arrangement with the Chicago Undergraduate Division of the University of Illinois, patients who have completed high school or have been awarded diplomas while at Hines are permitted to take proficiency examinations administered by the University after completing courses under the direction of the Educational Therapy Staff. If the University approves the patient for college study, he is enrolled under the supervision of the educational therapist. When the patient passes the proficiency examination, he receives credit for the course. After discharge from the hospital, he may enter the University of Illinois to continue his studies.

Since this college credit program was inaugurated in September, 1949, thirteen severely-disabled patients such as paraplegics, quadriplegics, tuberculous, and others have received college credit from the University of Illinois in accountancy, history, mathematics, political science, and psychology. At present thirty other patients with various disabilities are participating in this college credit program with the excellent cooperation of the University of Illinois.

Patients may receive Veterans Administration Certificates of Training after completing United States Armed Forces Institute (USAFI) Courses during their hospitalization under the supervision of the educational therapist.

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[6] "Data for State-Wide Planning of Veterans' Education." Federal Security Agency, U. S. Office of Education, Bulletin 1945, No. 4.

When the patient completes the course, the therapist administers the USAFI final examination, which is graded by the Extension Division of the University of Wisconsin at Madison. When the patient passes the examination he receives a Certificate of Training. High schools and colleges generally award credit to patients who have completed courses in this manner. From March 1, 1946, to July 1, 1951, a period of five years, 534 Certificates of Training have been issued to patients.

In addition to the usual academic subjects such as English, foreign languages, mathematics, social studies, science, and others, patients at Hines may study commercial subjects, including typewriting, shorthand, business law, bookkeeping and accounting, filing, and advertising in order to prepare for office clerical positions after discharge from the hospital. Business machine courses are also available, including stenotypy, vari-typing, and multigraph and mimeograph operation. Figure 3 shows paraplegic and partial quadriplegic patients learning the operation of office machines. The patients at the left are using standard typewriters. At the right the patient in the foreground is operating the vari-typing machine, which is used for duplicating paper work; the partial quadriplegic patient in the background is using an IBM electric typewriter. The partial quadriplegic and two of the paraplegic patients are attending college, taking courses in library science, business administration, and psychology, respectively. The other paraplegic is planning to do clerical work after his discharge from the hospital.

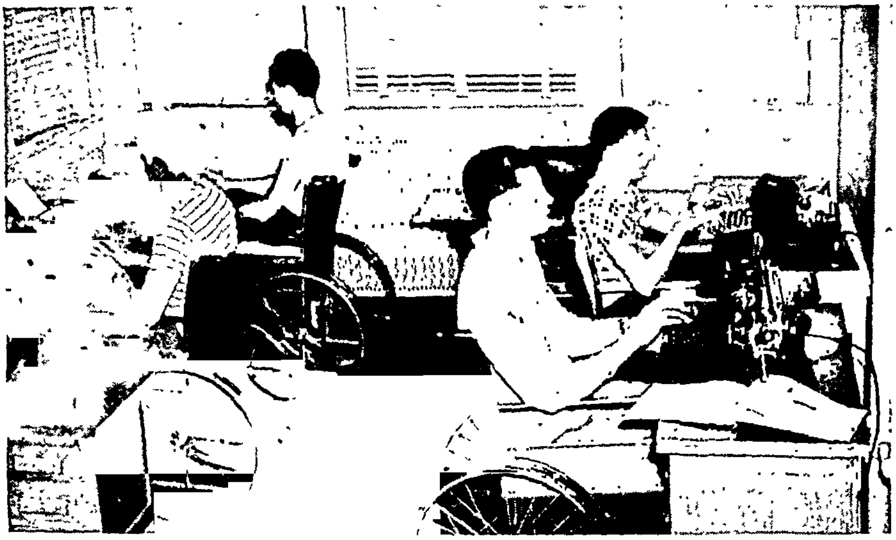

Fig. 3. — Paraplegia and quadriplegia patients operating standard typewriters, electric typewriters, and the vari-typing machine.

For quadriplegia patients and others who cannot operate standard typewriters because of inadequate function of the hands, electrical typewriters are provided. Numerous special assistive hand devices and slings helpful to such patients for use in typewriting, handwriting, eating, and other activities have been developed and described by many individuals. Several articles have been published concerning special devices originated at Hines.[7-8-9] Automatic page-turners are provided for patients unable to turn pages themselves because of their disability. Other special equipment available to pa-

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[7] Newman, Louis B.: "Special Hand Splints for the Disabled," Arch. Phys. Med. 28:770 (Dec.) 1947.

[8] Richert, Beverly J.: "Occupational Therapy for the Quadriplegia Patient," Am. J. Occup. Therapy 4:1 (Jan.-Feb.) 1950.

[9] Newman, Louis B., and Jameson, Elizabeth L.: "Assistive Devices for the Disabled," Occup. Therapy 30:8 (Feb.) 1951.

tients participating in Educational Therapy includes record players used in foreign language instruction and to develop rhythm in typewriting; and a wire recorder for use in courses in radio writing and speaking, English, and foreign languages. A disabled individual in a wheelchair can accomplish numerous types of endeavor as well as the normal person in a chair.

Building self-confidence is another advantage to the patient participating in Educational Therapy. By completing a course and/or obtaining his diploma during his hospitalization, the patient discovers that he can accomplish something worthwhile in spite of his disability, thus deriving a feeling of satisfaction and achievement. The realization that despite his handicap he can participate in various activities and attain valuable goals encourages and stimulates him to engage in activities designed to facilitate his recovery during his hospital stay. Then, too, the patient tends to think about his vocational or educational possibilities after discharge from the hospital.

Another benefit derived from Educational Therapy is resocialization, which is extremely important for psychiatric patients. Participation in Educational Therapy tends to make the patient think about matters other than those concerning himself and his situation, thereby helping him to accept his disability and better to reorganize his life. Attending educational therapy classes consisting of small groups of patients and participating in class discussions help to develop desirable habit patterns especially in the psychiatric patient.[2]

An excellent example of a valuable resocialization and therapeutic activity is seen in the ward newspaper published bi-monthly by psychiatric patients at Hines who are enrolled in Educational Therapy. All reporting, writing of copy, art work, proof-reading, stencil cutting, mimeographing, stapling, and distributing is done by these psychiatric patients, including a number of "locked ward" patients. This project helps to foster group cooperation and resocialization among patients who are primarily concerned with their own individual problems. Many of these patients become sufficiently motivated to work together to produce the newspaper. Such a project demonstrates the part that Educational Therapy plays in the total rehabilitation of psychiatric patients and participation in it develops valuable skills in English and journalism.

Summary

1. In this paper the authors have described Educational Therapy, an important component of the Physical Medicine and Rehabilitation Service, as it functions in the Veterans Administration, and more specifically, as it operates in the Veterans Administration Hospital, Hines, Illinois.

2. Educational Therapy plays an essential role in the rehabilitation of the sick and disabled veteran and functions in the hospital under the close medical guidance and supervision of the physiatrist.

3. Purposeful educational activities motivate the patient for further rehabilitation, measure and develop his work capacity, develop his occupational skills, raise his educational level, build his self-confidence, and develop socially acceptable habits and attitudes.

4. Educational Therapy aids in overcoming social, psychologic, and emotional difficulties that exist to some degree in all disabled persons.

5. The importance of treatment administered by properly qualified therapists cannot be over-emphasized. Continuous in-service training is vital to the functioning of an adequate Educational Therapy Program. Clinical re-

search and investigation should continue in order to maintain this phase of total rehabilitation on the highest possible level.

6. By integrating the educational activities with those of the vocational adviser and other members of the hospital rehabilitation team, the educational therapist helps plan, inaugurate, and evaluate the patient's rehabilitation program leading to gainful employment or further education and training. A very careful analysis and evaluation of the patient's needs is essential. He should be guided toward a goal wherein he will fit a definite job, and the job will fit him.

7. Educational Therapy should be seriously considered for patients in civilian hospitals and other institutions, whenever indicated and practical, as part of their physical and psycho-social adjustment. The patient as well as the staff must take full advantage of the hospitalization period.

8. Many disabled people who must lead a so-called wheelchair life, can, through total rehabilitation, be gainfully employed and perform duties as well as normal persons.

9. As part of total rehabilitation, Educational Therapy further aids the disabled to readjust and reorganize their lives for maximum productive usefulness and a future with happiness, satisfaction, respect, and dignity.

We are greatly indebted to the Educational Therapists at the Veterans Administration Hospital, Hines, Illinois, for their splendid accomplishments in the program, to Mr. James N. Burrows, M.A., Executive Assistant, Physical Medicine and Rehabilitation Service, for his valuable assistance, and to the Medical Illustration Laboratory for the excellent photographs.

Discussion

Dr. C. O. Molander (Chicago): This paper is an excellent presentation of a new phase of physical medicine.

I am impressed by the trend toward greater specialization in physical medicine as practiced in VA hospitals. There was a time when physical therapy was the sum and substance of physical medicine, and it consisted mainly of heat, massage, and exercise to the affected part. Later, occupational therapy was added, but unfortunately even today in most civilian hospitals there is far too little coordination of physical therapy and occupational therapy effort for efficient results.

Although total rehabilitation requires intense specialization, I wonder if the specialization can go too far and defeat its own purpose. With educational therapists, recreational technicians, corrective therapists, plus "coordinating" vocational advisors, who are "encroaching" on the erstwhile domains of physical therapists and occupational therapists, I wonder if there is a distinct line of demarkation between the duties of these various therapists so that duplication of effort and jurisdictional disputes may be avoided?

According to Dr. Newman, the educational therapist correlates his treatment with that of the vocational advisor, so that the specific rehabilitation program of the patient is coordinated with his post-hospital objective. What interests me is how many discharged patients continue their educational therapy after leaving the hospital?

The cost of this program should worry every civilian physiatrist. The average civilian hospital cannot afford such an array of therapists. The classes at Hines hospital are small, and it seems to me that only a "financially liberal government" can afford such procedures. Most large civilian hospitals have educational therapists for grade and high school students, but we don't call them therapists. They are teachers assigned by the city board of education who pay their salaries. Dr. Newman states a good point about physiatrists supervising the teaching program by telling the educational therapists how long the patients teaching sessions should last, the position — sitting or lying — the patient should assume, and other instruction beneficial to the patients' welfare. I must confess that we in civilian hospitals have not paid much attention to this phase of the teaching program, because the teachers are directly responsible to the board of education.

The educational statistics of the U. S. Armed Forces as of Jan., 1944, are interesting. Nearly eight million enlisted men served in our army, navy, air force, and coast guard — 30.2 per cent had at least a grammar school education; 24 per cent had high school but did not graduate; 31.2 per cent were high school graduates; less than 15 per cent had one or more years of college. I do not have the statistics of previous wars, but I believe the educational standards of our enlisted men in the last war, though still low, are far above the standard of previous wars.

In closing, Dr. Newman has presented an interesting new phase of physical medicine, which only government hospitals can afford. Educational therapy in civilian hospitals can be made more productive by maintenance of a closer relationship between the hospital physiatrist and the local boards of education.

COMBINATION THERAPEUTIC TANK AND POOL *

SAMUEL SVERDLIK, M.D.

NEW YORK

This paper is a description of a tank incorporating features of many existing therapeutic tanks and pools. It was designed for use in acute conditions in a general hospital, and requires moderate initial outlay and maintenance.

The equipment consists of a tank constructed of stainless steel, measuring fourteen feet in length, four feet in breadth, and having an overall depth of five feet. The overflow drains are located six inches below the surface, with a resultant four and one-half feet of water depth. The tank is counter-sunk into a reenforced concrete base with an above-floor height of thirty-three inches, which equals the average height of a transporting plinth. Around the outer surface of the tank are three movable agitators. Outlets are available on the outer panel for the electrical connections. At either end and in the middle of the tank are three upright bars with rotating steel resting cuffs. A perforated steel platform occupies the entire inner surface of the tank and

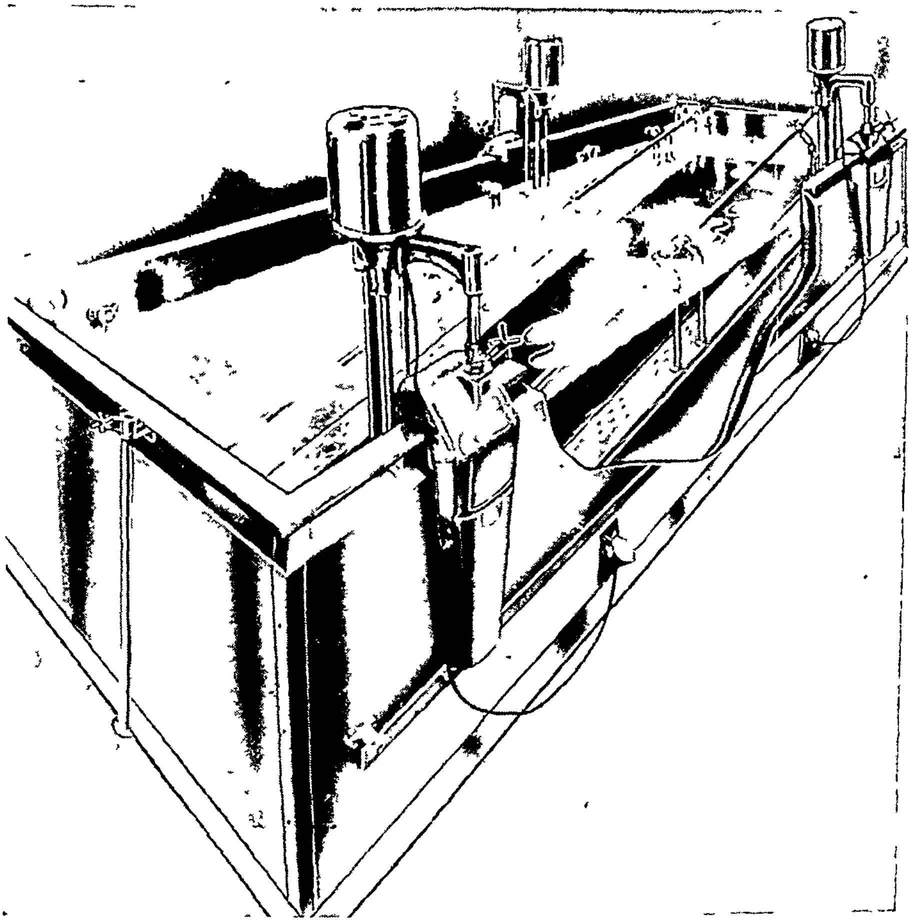

Fig 1. — A cutaway diagram showing the platform in the inclined position resting on the floor of the tank at one end and on the supporting cuffs at the other. Note the perforated steel platform with the rubber mat, and attached adjustable parallel bars

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* Read at the Twenty-Ninth Annual Session of the American Congress of Physical Medicine, Denver, Colo., Sept. 5, 1951.

can be placed at any desired height or inclination. Attached to the platform are two adjustable parallel bars with rotating adjustable arms to allow for the widening and narrowing of the space between the bars. Overhead is a steel I-beam on which are two lifting cranes used to raise and lower patients as well as the platform.

The water capacity of the tank (2500 gallons) is controlled by a single inflow valve with a thermometer attached to the main pipe, which allows for temperature regulation of the entering water. At either end of the tank are thermometers for checking water temperature

The purpose for which this tank was designed is two-fold: (a) To make available a therapeutic tank capable of use for underwater therapy; (b) To allow for ambulation of a patient with weakened lower extremities.

By inclining the platform, the degree of buoyancy is modified in the shallow portion and exercise value is derived from the added resistance of the body. Likewise, by raising the platform, children can be treated for gait training at a uniform working height

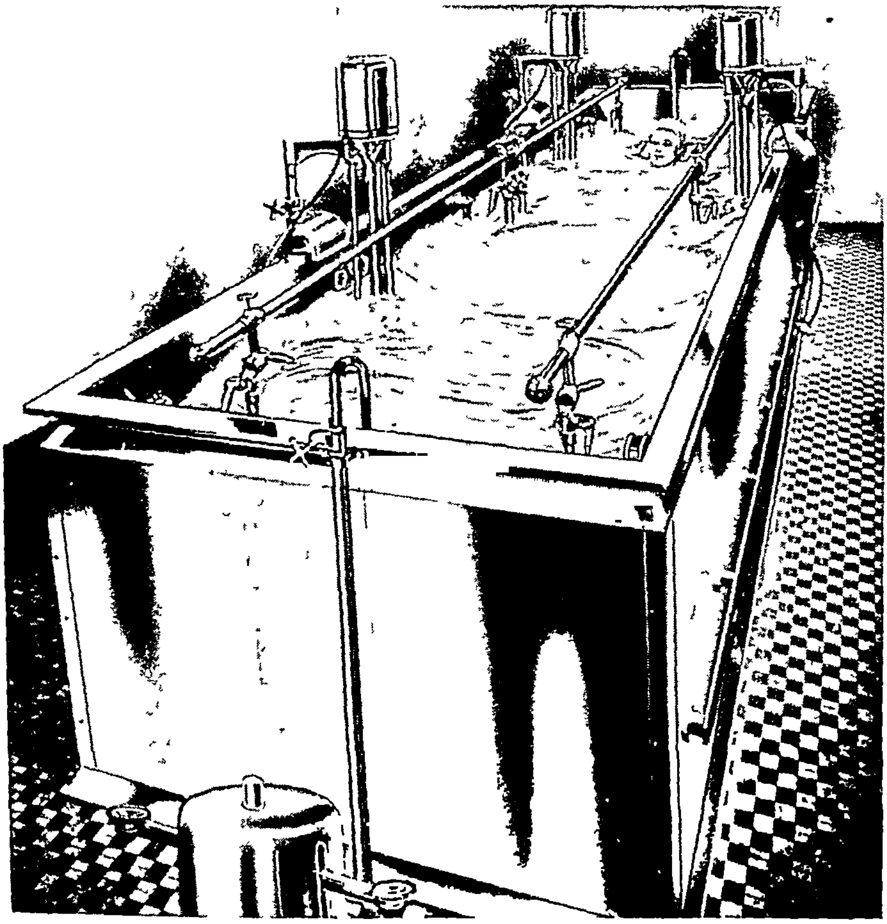

Fig 2 — A view showing the tank with the platform elevated and used as a therapeutic tank, the patient reclining on a headrest and canvas frame The cylindrical device in the foreground is the pedal operated drain valve which, when fully opened allows the tank to be emptied in twenty minutes

With the platform at its uppermost resting level, the water depth allows for underwater exercises. A head rest and canvas frame supports the patient's body. By shifting the patient to either side, full abduction of an upper and lower extremity can be achieved. Two patients can be treated simultaneously

This tank has been in use at St. Vincent's Hospital for the past nine months and has proved to be most useful for a variety of conditions, such as arthritis, poliomyelitis, back pain, chronic phlebothrombosis of the lower extremity, decubiti, lower extremity and pelvic fractures, as well as upper extremity fractures.

The dimensions of this tank afford an opportunity for administering treatment without need of a therapist entering the tank. Hygiene of the tank is controlled by a complete change of water daily, with addition of one ounce of "chlorox." Daily bacteriological counts are done in the hospital laboratories. The walls of the tank are washed down with standard soap powders. Throughout the day, while the tank is in use, there is a continuous flow of water.

Conclusions

A therapeutic tank in use at St. Vincent's Hospital has been described and its advantages and fields of application outlined.

Discussion

Dr. John D. Currence (New York, N. Y.): It has been my privilege personally to inspect Dr. Sverdlik's tank and to have the various features of it explained in detail.

In my opinion it has the widest range of really practical utility of any tank or pool with which I am acquainted. I congratulate Dr. Sverdlik on its development as a real contribution to Physical Medicine.

This tank provides accessibility of the patient to the therapist comparable to that of the Hubbard tank as well as our tank; but, in addition, it has underwater parallel bars at various platform levels, which is a most worthwhile feature. The only feature it does not have is that of rapid temperature change. However, to achieve relaxation and relief of pain, Dr. Sverdlik can use a tub or other means of heat induction just prior to putting the patient in his tank. This would create a certain problem in efficiency. It would be necessary to have an added modality plus the transportation of the patient and the timing of the two phases of the treatment.

Hydrotherapy in the past, as used at the various spas, has been used on a rather empiric basis but chiefly for the thermal effects. Our tank at University Hospital, which is the four leaf clover shaped tank produced by the Ille Electric Corporation, was designed primarily for the induction of low or moderate degrees of hyperpyrexia, often to be followed by underwater exercise and muscle training. There is such a large number of cases, particularly in the field of the rheumatic diseases, that I feel tanks primarily for thermal purposes continue to be essential.

I do feel, however, that tanks using the principles of Dr. Sverdlik's tank should really outmode ordinary pool therapy. I can visualize how many pools could be modernized by the construction of troughs of different depth and temperature, with aisles between for the therapist. I mention temperature at this time because we feel that the older patients we have seen with hemiplegia and osteoarthritis, exercise better in slightly warmer water than do most of the younger individuals with neurologic conditions. It seems that most patients undergoing underwater rehabilitation could be handled more efficiently using the principles of this new installation.

In order to supplement our present equipment to have underwater parallel bars, plans for a miniature tank comparable to Dr. Sverdlik's have been developed. It will be reduced in length from 14 feet to 8 feet, in width from 48 inches to 32 inches with the depth the same. The water capacity will be reduced from 2500 gallons to 640 gallons. Filling time of the smaller tank would be about 16 minutes. We have plans for a glass face on one side of the tank and a flood light to show up the markings on the floor of the tank. This feature will aid the therapist to observe the movements. The tank will be capable of a temperature fluctuation of 6 to 8 degrees F., within a few minutes. Of course with this small tank we shall not be able to handle the large number of patients for underwater ambulation which Dr. Sverdlik can. However, expense, floor space and the weight make it impractical for us to plan to duplicate his magnificent unit.

With regard to the tank hygiene, it is, of course, necessary to have a regular scrubbing, but in addition, we have been able in small tanks to achieve excellent sterilization within 15 minutes by using underwater ultraviolet irradiation placed in front of each of the hydroagitators. These ultraviolet units merely hook over the side of the tank when one wishes to use them.

Dr. J. Meislin (Montrose, New York): I would like to ask Dr. Sverdlik whether he considered a removable partition which would make the tank convertible into a smaller tank such as Dr. Currence described.

Dr. Fred J. Fricke (Fort Logan, Colorado): Does this tank have to be put on the ground floor so it can go into the ground, or could it be put on a higher floor?

Dr. Samuel Sverdlik (New York, N. Y., closing): Dr. Meislin's thought of partitioning this tank is a very worthwhile idea, but would present a number of technical problems. It would require two separate platforms, and also some sort of rubber gasket device to prevent the mixture of waters, and so on, which might make the idea impractical. It might be better to make two small tanks if that were desired.

Our tank is on the first floor. It is countersunk in reinforced concrete, and the laboratory of the hospital is beneath the tank. The tank represents no hazard to the laboratory.

MEDICAL NEWS

Members are invited to send to this office items of news of general interest, for example, those relating to society activities, new hospitals, education, etc. Programs should be received at least three weeks before the date of meeting.

Report of the Finance Committee

The report of our auditor which follows indicates that for the year ending December 31, 1951, the American Congress of Physical Medicine continued to operate on a sound financial basis.

Walter M. Solomon, M.D., Chairman
H. Worley Kendell, M. D.
Charles S. Wise, M.D.

Report on Examination
For the Year Ended December 31, 1951

June 9, 1952.

Board of Governors,
American Congress of Physical Medicine,
30 North Michigan Avenue,
Chicago, Illinois.

Dear Sirs:

We have examined the balance sheet of the American Congress of Physical Medicine as of December 31, 1951, and the related summary of net income and surplus for the year then ended Our examination was made in accordance with generally accepted auditing standards and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances, except as stated in the following paragraph.

We did not verify the income from subscriptions to "Archives," a magazine published monthly by the Congress, because it was not considered practicable. However, we tested the correctness of the subscription income recorded on the books by reference to available supporting data.

Based on our examination, limited to exclude verification of "Archives" subscription income, in our opinion, the accompanying balance sheet and summary of net income and surplus present fairly the financial position of the American Congress of Physical Medicine at December 31, 1951, and the results of its operations for the year then ended in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

We submit the following exhibits and schedules:

Exhibit
A—Balance Sheet, December 31, 1951.
Schedule
1—Accounts Receivable—Membership Dues.
B—Summary of Net Income and Surplus for the Year Ended December 31, 1951.
Schedule
1—Direct Convention Expenses.

Yours truly,
George Rossetter & Co.

Exhibit A

American Congress of Physical Medicine
(Incorporated in Illinois — Not for Profit)
Balance Sheet, December 31, 1951

Assets

Current Assets:		
Cash in bank and on hand		$ 9,976.22
Accounts receivable:		
Advertisers	$ 937.70	
Membership dues—Schedule 1	480.00	
American Registry of Physical Therapists	6,080.70	
American Board of Physical Medicine and Rehabilitation	156.06	
American Society of Physical Medicine and Rehabilitation	362.36	
Total	$8,016.82	
Less reserve for possible losses	250.00	7,766.82
Investment in United States Saving bonds, Series G—at cost		25,000.00
Accrued interest		218.67
Deposit at United States Post Office		50.00
"Archives" — paper stock and envelopes		2,150.66
Prepaid rent		200.00
Total		$45,362.37

Liabilities

Current Liabilities:	
Accounts payable	$ 2,204.93
Employees' income tax withheld	596.62
Pay roll taxes	99.63
Dr. John S. Coulter Memorial Fund	455.00

Subscriptions to "Archives"—unexpired portion	4,594.72
Dues collected in advance—year 1952	240.00
Total current liabilities	$ 8,190.90
Surplus, per Exhibit B	37,171.47
Total	$45,362.37

Exhibit B

American Congress of Physical Medicine
Summary of Net Income and Surplus for the Year Ended December 31, 1951

Income:			
Membership dues			$ 8,520.00
"Archives":			
Advertising		$7,832.58	
Subscriptions		15,305.19	
Sale of cuts, etc.		1,106.35	24,244.12
Interest on United States Government securities			614.51
Convention income:			
Exhibits		$5,625.00	
Special instruction course and banquet		2,269.00	
Total		$7,894.00	
Direct convention expenses—Schedule 1		6,168.08	
Convention income—net			1,725.92
Miscellaneous			134.08
Total income			$35,238.63
Expenses:			
Office salaries and expenses		$19,662.57	
Printing—"Archives"		13,024.63	
Cuts, half-tones, electros, etc.		1,303.47	
Pay roll taxes		169.23	
Professional fees		758.16	
Provision for loss on uncollectible accounts		214.25	
Sundry		299.89	
Total expenses		$35,432.20	
Less share of office expense billed to:			
American Board of Physical Medicine and Rehabilitation	$ 250.00		
American Society of Physical Medicine and Rehabilitation	120.00		
American Registry of Physical Therapists	7,200.00	7,570.00	
Expenses—net			27,862.20
Net income for the year			$ 7,376.43
Surplus at beginning of the year			29,795.04
Surplus at end of the year			$37,171.47

Report on Examination
For the Year Ended December 31, 1951

June 9, 1952.

Board of Registry,
American Registry of Physical Therapists,
30 North Michigan Avenue,
Chicago, Illinois.

Dear Sirs:

We have examined the balance sheet of the American Registry of Physical Therapists as of December 31, 1951, and the related statement of net income and surplus for the year then ended. Our examination was made in accordance with generally accepted auditing standards and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion, the accompanying balance sheet and statement of net income and surplus present fairly the financial position of the American Registry of Physical Therapists at December 31, 1951, and the results of its operations for the year then ended in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

We submit the following exhibits:

Exhibit
A—Balance Sheet, December 31, 1951.
B—Statement of Net Income and Surplus for the Year Ended December 31, 1951.

Yours truly,
George Rossetter & Co.

Exhibit A

American Registry of Physical Therapists
(Incorporated in Illinois — Not for Profit)
Balance Sheet, December 31, 1951

Assets

Current Assets:		
Cash on deposit		$22,274.57
Accounts receivable — dues and registration	$ 529.00	
Less reserve for possible losses	200.00	329.00
United States Savings bonds, Series G—at cost		19,500.00
Accrued interest		122.91
Total		$42,226.48

Liabilities

Current Liabilities:	
Accounts payable—American Congress of Physical Medicine	$ 6,080.70
Accrued federal excise tax	13.00
Refunds due members	7.00
Dues collected in advance—year 1952	8,700.00
Deposits with applications (subject to refund if applications are rejected)	225.00

(*Continued on page 493*)

ARCHIVES of PHYSICAL MEDICINE

OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL MEDICINE

.·. EDITORIAL .·.

CLINICAL RESEARCH IN PHYSICAL MEDICINE

During the past ten years physical medicine has gained recognition as a major medical specialty. This development of specialty status has been due to several factors: (1) "physiological" studies to demonstrate the specific effects of the various techniques of treatment, (2) "clinical" studies and adequate demonstrations of the value of therapy, and (3) surveys of physical disability in the general population which demonstrate the need for special training for and special consideration of the techniques of physical medicine and rehabilitation.

"Physiological" studies either on patients or animals have been carried out using methods of investigation which make it possible to give quantitative evaluation to a selected phase of treatment. For example, diathermy, because of its penetrating heat, has been studied in considerable detail. The relative effectiveness for producing deep heating of the various machines and various techniques of applying electrodes has received much attention for many years. Quantitative studies of deep heating have been possible because adequate methods of measurement are available. Investigations of the effects on the circulation of the blood of heating by diathermy have been more difficult. Methods for evaluating blood flow without interrupting the circulation or its nervous control are less direct than methods for measuring temperature. The relative effects of diathermy on blood flow through the skin, the subcutaneous tissue, and deep muscle have been more difficult to establish and still are subjects of controversy. The demonstration that heat applied to the back over the region of the kidneys decreased rather than increased renal blood flow, emphasized that vasomotor responses in all parts of the body do not always change in the same direction but rather that the maintenance of homeostasis may result in compensatory changes in opposite directions. Because of these compensatory mechanisms, which may respond differently to methods of treatment which appear similar, it is necessary to check new methods or modifications of methods to be sure that the desired effects are obtained. A pertinent report in this regard demonstrated that attempts to use radiant heating, conduction heating, or surface or intravaginal short wave diathermy to produce high intrapelvic temperatures were far less effective than the intravaginal long wave diathermy which was being replaced.[1] Comparative studies like this must be continued, not only to prevent the loss of value of a treatment by the adoption of inferior techniques, but also to recognize and adopt improved techniques.

"Clinical" evaluation of the effects of therapy usually means the collection of a series of similar patients and from their responses to treatment the drawing of conclusions regarding the value of the treatment. There are fundametal handicaps to this type of "clinical" research: (1) Objective methods of measuring effects are lacking. (2) It is difficult to get a series of patients with similar degrees of disability. (3) Collection of a group of patients with identical abilities, as well as disabilities, may require a number of years during which time the basic care of the patient may change. (4) The need to cater to the individual demands of each patient makes complete control of the clinical test difficult. (5) Personality, environment, and motivation complicate the evaluation of the response to a therapy. (6) Most difficult of all is the establishment of the contratest or control group, particularly for the basic comparison of a treatment against maintenance without treatment, so that statistical analyses can be made. As a result clinical studies frequently consist of case histories and reports of impressions. Nevertheless, the past war provided the basis for clinical evaluation of the methods used for treating certain types of disabilities. Large groups of men who had similar conditioning and similar abilities were brought together for treatment in a situation in which treatment, activity, and maintenance could be controlled. Series of patients were large enough for statistical significance. As a result the techniques of rehabilitation quickly were demonstrated to be superior to the well established "rest cure." However, except in restricted areas of rehabilitation, quantitative comparison of methods was not attempted.

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[1] Miller, R. N.; Horvath, S. M.; Day, C.; Sweeney, F. X.; Rubin, A.; Mellette, H.; Smith, F., and Hutt, B. K.: An evaluation of various *methods* of heating vaginal and adjacent tissues, Arch. Phys Med. 31:721 (Aug.) 1950.

Finally, the demonstration that the techniques of rehabilitation were of such importance in the restoration of disabled soldiers stimulated civilian organizations to assess their own facilities and needs. These surveys of the civilian population indicated that rehabilitation of the physically handicapped was one of the major medical needs today. The recognition of the tremendous needs for this specialized medical care was an important factor in leading to the establishment of physical medicine and rehabilitation as a specialty.

Future progress in physical medicine must depend on the development of methods which provide quantitative evaluation of the techniques of rehabilitation. The clinical demonstration of the superiority of physical medicine over simple "rest" has been made. The surveys of need have produced the demand for services. Advances now depend on determination of the best among the present methods of treatment and development of new and better methods of treatment. Such evaluation requires quantitative methods. The need for adequate methods of quantitative evaluation is particularly urgent in the field of therapeutic activity. Aside from manual testing of muscular strength or range of joint motion, evaluation of activity is largely an impression. Objective and uniform methods have not been developed. For example, patients who have received injuries to the central nervous system may be given surprisingly different evaluations concerning spontaneous recovery because of the lack of objective methods of testing. Entirely different methods of treatment of a disability with therapeutic activity are hypothesized to give the "best" recovery compared to the hypothetical state which would have existed without treatment. The hypothetical value of each type of therapeutic exercise is brought forward in support of that method. Proof of the value of the therapy is presented as case histories of patients whose conditions were not standardized nor static before treatment and whose recovery can scarcely be attributed to any specific type of therapeutic activity because of many significant changes in their regimen. Few authors presenting clinical studies have enough control over those patients so that they can present a series of similar cases receiving standardized treatment adequate for statistical analysis. More important, unless each series of patients can be compared against a contratest series, statistical and quantitative evaluation is not possible. Eventually the different methods of treatment advocated for any pathological condition must be tested comparatively by quantitative methods and in series large enough to be statistically significant. The more precise the methods of measurement are, the smaller these series may be. Thus the great need in the field of therapeutic activity today is to develop quantitative methods for testing coordination, speed, and skill. Adequate comparison of present methods of therapy awaits the development of such quantitative tests. Leads for improvement of treatment also will depend on the outcome of quantitative testing.

Medical News

(*Continued from page 490*)

Total current liabilities		$15,025.70
Surplus, per Exhibit B		27,200.78
Total		$42,226.48

Exhibit B

American Registry of Physical Therapists
Statement of Net Income and Surplus
for the Year Ended December 31, 1951

Income:		
Dues	$10,468.00	
Registration fees	8,584.00	
Sales:		
Pins	742.50	
Emblems	358.75	
Directory	313.25	$20,466.50
Interest on United States bonds		431.26
Miscellaneous		7.50
Total income		$20,905.26
Expenses:		
Share of office expense billed by American Congress of Physical Medicine	$ 7,200.00	
Printing and multigraphing	927.01	
Directory	846.92	
Examinations — supervision and grading	318.29	
Board meeting	377.28	
Purchase of pins	510.20	
Office supplies	310.15	
Telephone and telegraph	1.75	
Postage	49.41	
Office equipment	681.84	
Fidelity bond premium	45.27	
Professional fees	554.33	
Provision for losses on uncollectible dues	130.00	
Purchase of emblems	143.26	
Exhibit expense	376.70	
Donation to Dr. John S. Coulter Memorial Fund	100.00	
Miscellaneous	116.85	
Total expenses		12,689.26
Net Income for the Year		$ 8,216.00
Surplus at Beginning of the Year		18,984.78
Surplus at end of the Year		$27,200.78

AMA Meeting

At the recent meeting of the AMA in Chicago, the Section on Physical Medicine and Rehabilitation had nine exhibits. Two of these received honorable mention. Dr. **Arthur L. Watkins,** Boston, Mass., was the Section representative.

Dr. **Grace M. Roth,** Rochester, Minn., was awarded the Gold Medal for an exhibit on pheochromocytoma.

Dr. **Howard A. Rusk,** Chairman, Section on Physical Medicine and Rehabilitation, pointed out the economic dividends of rehabilitation, followed by discussions of rehabilitation of the hemiplegic, paraplegic and poliomyelitis patient.

Dr. **O. Leonard Huddleston,** Santa Monica, Calif., pointed out the value of electromyography in the diagnosis of abnormalities of the neuromuscular system and in the presentation of scientific evidence to civilian courts our veteran and military adjudication boards.

A Reference Committee on Industrial Health was appointed, with Dr. **Frank H. Krusen** as a member.

Consideration was given to setting up a Health Home Council under qualified medical guidance. The purpose of the Council would be to promote research and spread authentic information to the public, to industry and to professional groups concerning work simplification and energy-saving devices for housewives with cardiac, tuberculous, or other severely disabling diseases. The Joint Committee on Rehabilitation of the Council on Industrial Health and the Council on Physical Medicine and Rehabilitation is concerned with employment opportunities for the handicapped and this committee is to investigate and make recommendations to the Board of Trustees and the House of Delegates, A. M. A.

Dr. **Earl C. Elkins,** Rochester, Minn., presented a paper on "Hemiplegia: Treatment in the Acute Phase." Dr. **Sedgwick Mead,** St. Louis, Mo., was the discussor.

Dr. **Leonard J. Yamshon,** Los Angeles, Calif., presented the topic "Hemiplegia: Rehabilitation Procedures," which was discussed by Drs. **Harold Dinken,** Denver, and **Joseph G. Benton,** New York.

Drs. **Donald A. Covalt** and **Howard A. Rusk** read a paper entitled "Early Management of the

Paraplegic." Dr. **Louis B. Newman**, Hines, Ill., discussed the topic.

A paper on "Poliomyelitis: Present Concepts of Physical Medicine and Rehabilitation," was given by Dr. **Duane A. Schram**, Gonzales, Texas.

At the Section on Physical Medicine and Rehabilitation, the following papers were presented: "The Council on Physical Medicine and Rehabilitation," by Dr. **Ralph E. DeForest**; "Scapulocostal Syndrome: The Pathology, Diagnosis and Treatment," by Dr. **Allen S. Russek**, and "Clinical Aspects of Geriatric Rehabilitation," by Dr. **Michael M. Dacso.**

A Symposium on Cerebral Palsy was held with Dr. **George G. Deaver** acting as moderator. The following papers were included: "Differential Diagnostic Hints in Cerebral Palsy," by Dr. **Meyer A. Perlstein** and "Surgical Procedures in Cerebral Palsy," by Dr. **Harry E. Barnett.**

New Physical Therapy Course

Marquette University Medical School, Milwaukee, Wis., for the first time will offer a course in physical therapy this fall in the Department of Physical Medicine and Rehabilitation. Dr. Ray G. Piaskowski will be in charge of the program. The four year course will be limited to 20 students.

International Congress of Physical Medicine

At the recent Congress held in London, England, July 14-18, the following members of the American Congress of Physical Medicine participated: Frank H. Krusen, "Review of Physical Medicine in the Past Decade"; Lt. Col. John H. Kuitert, "Symposium on Physical Education"; Howard A. Rusk, "Symposium on Rehabilitation and Resettlement"; Robert L. Bennett, "Supportive and Assistive Apparatus in Convalescent Poliomyelitis"; Miland E. Knapp, "Results of Treatment of Acute Poliomyelitis at the Kenny Institute"; Alvin B. C. Knudson, "Physical Medicine and Rehabilitation in the Veterans Administration"; Frederic J. Kottke, "Studies on Vasomotor Activity in the Feet Following Acute Anterior Poliomyelitis"; Edward W. Lowman, "Rehabilitation of the Chronic Rheumatoid Arthritis Derelict," and William D. Paul, "Studies on Permeability of the Synovial Membrane."

Hospital to Treat Arthritics Only

Beginning September 1, 1952, the Leo N. Levi Memorial Hospital, Hot Springs, Arkansas, will be devoted entirely to treatment and research in the field of arthritis.

Dr. McGuinness Receives Medical Society Award

For her efforts in advancing the interests of women in medicine, Dr. Madge C. L. McGuinness, Associate Editor of Medical Times, recently received the 1952 award of the Women's Medical Society of New York State.

A specialist in physical medicine, Dr. McGuinness is chairman of the special committee on physical medicine of the New York County Medical Society.

Henry D. Holman

It is with sincere regret that we announce the death of Dr. Henry D. Holman of Mason City, Iowa. Dr. Holman was a Congress member for many years.

Newly Registered Therapists

June 17, 1952

Ball, Oliver Kennett, 714 W. Maple St., Enid, Okla.

Houseman, Elizabeth Ann, 551 Wadsworth Rd., Medina, Ohio.

Mendenhall, Charles Alva, 115 First Ave., Jonesboro, *Indiana.*

June 19, 1952

Baker, Priscilla Marie, 24 Everett St., Lynn, Mass.

Dempster, Sarah Joan, 903 Walnut, Cedar Falls, Iowa.

Galt, Elizabeth Allen, 14 Barton Rd., Mountain Lakes, N. J.

Miller, Jacqueline Colheen, Rt. 3, Murray, Ky.

Roberts, Alma Marcella, 317 Tremont St., Michigan City, Ind.

Thibaut, Jean, 325 E. 16th St., Hialeah, Fla.

Torp, Louise A., 715 S. Jay St., Aberdeen, S. Dak.

Personals

Lt. Col. **Edward B. Shires** recently presented a lecture-demonstration on Electromyography in the Electrical Evaluation Course.

Dr. **Ralph De Forest**, Chicago, presented the topic "Factors Concerned with the Medical Application of Ultrasound" at the June 26 meeting of the American Institute of Electrical Engineers held at the Nicollet Hotel, Minneapolis.

Dr. **Harold Storms**, Director of the combined OT-PT Course, sponsored by the Puerto Rican State Insurance Fund, visited the offices of the American Occupational Therapy Association to review the plan and development of his new program with the staff.

Body Mechanics Group to Meet

On Sunday, August 24, 1952, beginning with luncheon at 12:00 noon, at the Hospital for Bone and Joint Disease in New York City, a meeting of those interested in body mechanics will be held. The following topics will be discussed: Body Mechanics; Gross Microscopic and Functional Anatomy Pertaining to the Skeleton, Muscle System, and Connective Tissue Structures; Balance, Mobile vs. Static; Paralysis; Concept of the Pathogenesis of Physical Disability; Concept of the Mechanisms of Physical Disability; Effects of Changes in Motor Structural Balance and Muscle Extensibility.

BOOK REVIEWS

The reviews here published have been prepared by competent authorities and do not necessarily represent the opinions of the American Congress of Physical Medicine.

RECENT PROGRESS IN HORMONE RESEARCH. THE PROCEEDINGS OF THE LAURENTIAN HORMONE CONFERENCE. Edited by *Gregory Pincus.* Volume VI. Cloth. Price, $8.50. Pp. 431, with illustrations. Academic Press, Inc., New York, 1951.

The past decade will unquestionably be recognized as epochal in medical history, transforming contemporary physiologic concepts through the brilliant interpretations of the major role played by the internal secretion as dramatized by the clinical metabolic effects inherent in ACTH and cortisone. Within this amazing short period the name of "miracle" drugs have entered the nomenclature of household conversation and scholarly lectures as evidence of beneficial results in a host of maladies, demonstrated by laboratory and bedside studies. The brilliant generalizations by Selye illuminated the factor of "Stress" and physiologic adaptation as one of the corner stones in the response of living tissue. Least to be recognized for their profound studies in the interpretation of the influence of various hormones and steroids is that highly respected group of unsung scholars who virtually played a creative role by their fundamental and meticulous contributions to the physiologic chemistry of internal secretion.

The book under consideration will be accepted as one of the highest examples of coordinated scientific discussions of "Recent Progress in Hormone Research." It is the sixth volume of the notable proceedings of the Laurentian hormone conference under the scholarly editorship of Gregory Pincus, and financially supported as a tribute to the spirit of research in science by an impressive group of American biochemical manufacturers. Despite the highly formal nature of the subject, the tone of presentation and critical discussions merits mention, for seldom has so formal a subject been presented under more lively good fellowship and keen evaluation. Twelve papers were presented by unquestioned authorities, each topic representing a corner stone of hormone influence on the many variables related to vital function. The increased orientation derived from these contributions should benefit every specialty and particularly physical medicine. According to Selye, of the 24 entities modifying his general adaptation syndrome theory, twelve are evoked by such factors as heat, cold, electricity, radiation exercise, to mention a few of the cardinal measures incorporated in our practice. Thus no progressive student or practitioner of physical medicine can afford to hold on to tenets of our yesterdays in the face of the new discoveries and their interpretations demonstrating the profound influence of the physical forces in health and disease through its influence on hormone metabolism. This book is not easy reading, but will be found highly rewarding for those who seek information on the widening horizon of physiologic response to steroid and hormone chemistry.

ALLERGY: FACTS AND FANCIES. By *Samuel M. Feinberg,* M.D., Associate Professor of Medicine, Chief of Section of Allergy and Director of Allergy Research Laboratory, Northwestern University Medical School. Attending Physician, Passavant Memorial Hospital. President (1942-44) American Association for the Study of Allergy (now American Academy of Allergy). Cloth. Price, $2.50. Pp. 173. Harper & Brothers, New York, 1951.

This book touches upon practically every aspect of allergy that would concern the general reader or the patient, and its purpose is to impart to the public such information as will promote intelligent cooperation between patient and physician. For this reason it omits specific directions for the use of diets and drugs, and emphasizes, instead, the facts and assumptions that underlie such use.

This makes the critical reader wish for a companion volume in which a writer with the author's immense experience would examine rigorously the logic at the bottom of all this work. That there is much wrong here must be apparent to anyone who studies the reasoning exemplified in this book or views the erratic results achieved by allergists. As an example, there is the discussion of skin tests (page 117 ff.). Apparently, no matter how a skin test turns out, a good allergist can account for it by an appropriate ad hoc hypothesis, and if a scratch test gives one result while the intradermal test gives another, one chooses whichever result agrees with the result of some third test. The author's discussion of skin tests does not do justice to the confusion in this field or fully suggest the amount of futile scarifying, injecting, medicating, dieting, house cleaning, and moving that has resulted from ill-considered skin testing. If done on a large scale by poorly supervised helpers in crowded offices, skin testing can become the worst sort of mechanical medicine. Yet on page 67 a skin test is accepted as conclusive proof of allergy to peas. Not only that, but the author is willing, on this basis, to believe in the possibility that volatile substances from peas can cause asthma, but unwilling, despite much better evidence, to believe that volatile substance from corn can do the same. An investigator's estimate of the frequency of allergy to corn will depend on whether he used skin tests or used other more reliable criteria, such as specific diet trials. In allergy it is literally true that the proof of the pudding is in the eating. Hence the author's remark (page 71) that allergy to corn is rare in his experience is irrelevant to his argument. So is the remark (page 72) about the littleness of the group who believe that even purified foods can produce allergy, unless the truth of a proposition is to be decided, from now on, by counting to see how many people believe it. Further, to create prejudice by calling one's opponents "faddists" may be customary as a trick in political debates but is not in place (page 72) in scientific writing. These instances raise doubts as to the logical soundness of other parts of the book. That it does not always represent the unanimous opinion of allergists is further seen on page 131, where the author states that tolerance to food allergies can be created by gradually increasing the amounts of the offending food in the diet. Some allergists consider this an outmoded idea that does not work.

This volume can be recommended to mature readers as summarizing the present opinions of one authority in a field that is in a state of confusion and flux.

THE AMERICAN ACADEMY OF ORTHOPEDIC SURGEONS INSTRUCTIONAL COURSE LECTURES. VOL. VIII. Editor, *Charles N. Pease,* M.D., Chicago, Illinois, and Associate Editor, *Sam W. Banks,* M.D., Chicago Illinois. Cloth. Price, $6.50. Pp. 356 with numerous illustrations. J. W. Edwards, Ann Arbor, Mich., 1951.

If one cannot attend these excellent instructional courses, the study of this book will serve as a worthy substitute. The forty-seven lectures present the very latest material by outstanding authorities.

The first chapter of fifteen papers covers medullary fixation. Both civilian and military orthopedists discuss their experiences with a total of over seven hundred femoral nailings. From the conclusions reached by these men this new technique will be used more frequently. Therefore the physiatrists and therapists in departments of physical medicine would do well to know more about it. The longest article in the group is entitled, "Complications and Errors in Technique," and is written by Dr. J. Albert Key. His frankness and critical style of writing is an excellent choice for evaluation of a new procedure. He reports on 50 complications occurring in their 84 cases showing that technical difficulties do occur.

Chapter II is on Cortisone and ACTH. An article by Kendall discusses the development and chemistry, one by Hench on the results in rheumatic diseases, another by Coventry on periarthritis of the shoulder and the last article by Bickel on orthopedic surgery and the effect of these drugs. The last three authors stress the importance of the physiatrist and his department. The following quotation from Dr. Bickel shows an orthopedist who has compassion for those in physical medicine: "of greatest value is close cooperation of the physical therapy department. Theirs is the constant tedious routine which prods and encourages these patients on to greater mobility and activity. Cortisone and ACTH have lightened their load and brightened our results."

Chapter III is a general discussion of radioactive substances used in medicine written by Dr. Murray Copeland. It is a clear, concise article about isotopes telling about their history, simple physical laws and their clinical and research use.

A section on human development and growth gives much statistical information. The second article analyzes the results of the Harvard anthropological survey that was conducted in Ireland of 10,000 Irish males. This is a comprehensive study and differs from most in that it concerns adult morphological changes. The author believes much additional data could be accumulated by various groups, and he mentions the orthopedic surgeons particularly, by starting a long term project on growth and development and offers the suggestion that measurements be made "at successive annual meetings — presumably before the annual banquet." No doubt the author had reasons for measuring the members before rather than after the annual banquet, proving that the orthopedists' banquet follows the usual pattern of other professional groups.

The chapter on the problems in the management of malum coxae senilis by Dr. Steindler is excellent. It is a straightforward, authoritative assessment of a most difficult arthritic condition. The explanation for pain in this disorder is particularly good; and the plea for various types of conservative treaments demonstrates a wide experience in the care of these patients.

Poliomyelitis is considered in two chapters; one on the epidemiological aspects and the other on treatment. The latter includes these statements "they [the principles of treatment of poliomyelitis in the acute and convalescent stages] are the particular concern of the orthopedic surgeon" and "the orthopedic resident is called to evaluate the patient at the time of admission and he is responsible for all orders affecting the care of the musculoskeletal system." Such statements indicate a failure to recognize the contributions of physiatrists and their departments of physical medicine in the total care of the polio patients. On very rare occasions the author uses the terms "physiotherapy" and "physiotherapist," which are somewhat prehistoric. These slights are not too irritating and perhaps are not intentional; for on the whole the article is complete and very well done, and includes the latest concepts on treatment.

This is the type of book that should be helpful to personnel in physical medicine. Not every article will be of equal interest or value but each one contains some general or new material that concerns patients that are referred to the physical medicine department. The American Academy of Orthopedic Surgeons is to be commended for publishing this volume and thus making this information more widely available.

MODERN HEADACHE THERAPY. By *Arnold P. Friedman,* M.D., Physician in Charge of the Headache Clinic, Montefiore Hospital; Assistant Professor of Clinical Neurology, Columbia University Medical School. Cloth. Price, $4.00. Pp. 154. The C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, 1951.

This book helps to clarify a much confused subject. It is obvious that the author has had a wide experience in the management of chronic headache. He wisely stresses the physiologic and psychologic mechanisms rather than over-emphasizing purely organic factors. Due credit is given to Dr. Harold G. Wolff and his co-workers, whose pioneer work on the physiologic basis of head pain has contributed so greatly to a better understanding of this common symptom.

This is more than a manual of therapy since diagnosis of the various types of headache is also well covered. Although very little new material is presented in this volume, it does bring together for easy reference most of the modern advances in therapy.

In the treatment of headache, two chief goals are sought — symptomatic relief for the individual attack and prevention of the attacks altogether. Unfortunately, these goals are not easily attained, especially the latter. Treatment may consist of pharmacotherapy, psychotherapy, physiotherapy, or surgery, individually or in combination. Physiotherapy and surgery are of limited usefulness.

Unfortunately the book contains a number of statements which have not been proven and do not fit in with the clinical experience of other workers. That "cerebral atherosclerosis may be accompanied by headache," is true, but any causal relationship is quite doubtful. Many physicians could not agree that "persons with low blood pressure may also be subject to headache" or that "diseases of the coronary arteries may give rise to a headache on the basis of circulatory insufficiency." It is doubtful that head pains are usually a prominent and early complaint in blood dyscrasias or that a blood sugar level of 60 to 90 mgm. per 100 cc. is typically associated with hypoglycemic headaches.

All in all, however, this is a valuable and much needed book and can be highly recommended for any physician who sees patients with headache — which means any physician in the active practice of medicine. If the therapeutic principles and suggestions outlined by Dr. Friedman are followed, there will be fewer teeth extracted, sinuses treated and glasses changed, and the headache sufferer will have a much better chance of being relieved of his painful affliction.

PATIENT'S DOING FINE. KNOW YOUR DOCTOR AND YOUR HOSPITAL. By *David M. Dorin,* Cloth. Price, $2.50. Pp. 122. Vantage Press, Inc., 230 W. 41st St., New York 18, 1951.

A neat little book for prospective patients or patients in a hospital written by a man who has keen understanding of their thoughts and reactions both to hospitals and the medical profession. He explains the workings of a hospital and the personnel who work in it, sensibly and effectively. It is not maudlin or emotional in the least. If it were possible to remove the two from the price of the book, it would have much wider distribution and probably reach the people who need it most.

A TEXTBOOK OF GENERAL PHYSIOLOGY. By *Hugh Davson,* D.Sc. (London). Scientific Staff, Medical Research Council; Honorary Research Associate, University College, London. Cloth. Price, $7.00. Pp. 659 with 286 illustrations. The Blakiston Company, Philadelphia 5, Pa., 1951.

The great majority of physiology textbooks are devoted largely to the study of mammalian physiology. Early in this century two great textbooks of General Physiology were published, one by Starling and the other by Bayliss. Starling's text is still one of the outstanding texts today but, unfortunately, Bayliss' General Physiology is no longer in print. The present writer Doctor Davson, from the same institution as Starling and Bayliss — namely, University College, London — presents in this book, the results of modern research carried out by workers with the viewpoint of the general physiologist — that is the work of the investigator who attempts to explain living phenomena in the terms of concepts familiar in the basic sciences of physics and chemistry.

In writing this text the author has been guided by the requirements of several types of reader; first, the degree student in physiology and related subjects such as zoology and botany; and second, the medical student who is willing to absorb more than the quantum considered necessary for a medical education. The author has also given consideration to the mammalian physiologist who wishes to understand what his general physiologist colleagues are doing, both for his own interest as well as for the purpose of teaching.

Doctor Davson assumes that the reader has some knowledge of the principles of physics and chemistry. The textual material is presented in six different sections and each section is again subdivided into chapters, of which there are a total of twenty-two. The sections are as follows: the structural basis of living matter; transformations of energy in living systems; the transport of water and solutes; characteristics of excitable tissue; the mechanism of contraction of muscle; and finally, light: its effect on and its emission by the organism.

Physiology is greatly indebted to the author not only for the able presentation of his subject, but also for his unusual discrimination of the material selected for study. This is a book that should be included in the library of everyone who is interested in physiology. It is written in clear concise language, well illustrated. The microphotographs are of unusual calibre and clarity. Each chapter closes with an excellent list of references and there are ample footnotes whenever necessary. This book of general physiology is indeed welcome.

CONFERENCE ON PROBLEMS OF AGING.

TRANSACTIONS OF THE THIRTEENTH CONFERENCE, FEBRUARY 5-6, 1951, NEW YORK, NEW YORK. Edited by *Nathan W. Shock*, Chief, Section on Gerontology, National Heart Institute, National Institutes of Health and the Baltimore City Hospitals, Baltimore, Maryland. Cloth. Price, $4.00. Pp. 194, with illustrations. Josiah Macy, Jr. Foundation, 565 Park Ave., New York, 1951.

This interesting conference on problems of aging was participated in by a group of seventeen scientists, including seven members of the conference and ten guests. Included were discussions of the endocrine aspects of aging by Earl T. Engle, cardiovascular aspects of aging by J. Murray Steele, summary of activities of federal agencies by Clark Tibbitts, forecast of the Second International Congress on Gerontology by Edmund V. Cowdry, aging of the integumentary system by Edmund V. Cowdry, and the biology of cell division by W. Jacobson.

The erudite discussions of this wise group of conferees are thought - provoking, and although much of the discussion as noted by the chairman "opens up more problems than it solves," nevertheless, as he adds, this is what research work "should do."

The book will be of interest to any physician concerned with the study of problems of aging.

HORMONES AND BODY WATER.

By *Robert Gaunt*, Ph.D., and *James H. Birnie*, Ph.D., Department of Zoology, Syracuse University, Syracuse, New York. Publication Number 10s, American Lecture Series. A Monograph in Physiology. Edited by Robert F. Pitts, M.D., Ph.D., Professor of Physiology and Biophysics, Cornell University Medical College, New York, N. Y. Lexide. Price, $2.25. Pp. 57 with four figures. Charles C Thomas, Publisher, 301-327 East Lawrence Avenue, Springfield, Illinois, 1951.

This is another of those interesting monographs in the American Lecture Series published by Charles C Thomas. This particular monograph is one in American Lectures in Physiology written by Doctors Gaunt and Birnie under the editorship of Doctor Robert R. Pitts of Cornell.

The authors had as their motive in writing "Hormones and Body Water" the correlation of the present knowledge of the role of the endocrine system in the normal and pathological physiology of fluid metabolism.

Gaunt and Birnie point out that the maintenance of proper levels of the body fluids is complex because the rate of water and salt intake is erratic and its extra-renal loss as by sweating is variable and relatively independent of the amounts of body water available. While the body can tolerate considerable variation of its total water content the processes of adjustment, they point out, although definite, are sometimes slow.

Chapters are given to the following subjects: evolutionary considerations; the posterior pituitary antidiuretic hormone; the adrenal cortex; the thyroid, the adrenal medulla; the pancreas; the gonadal hormones; toxemias of pregnancy; the liver; the adaptational syndrome; water intoxication; and water metabolism in the newborn. The monograph closes with excellent and well chosen references for further study. The monograph is well written and the material admirably presented. Clinical medicine is indebted to these authors for so able a presentation of such a timely subject.

PHYSICAL MEDICINE AND REHABILITATION FOR THE CLINICIAN.

Edited by *Frank H. Krusen*, M.D., Professor of Physical Medicine, Mayo Foundation and Head of Section on Physical Medicine and Rehabilitation, Mayo Clinic, Rochester, Minnesota. Articles contributed by 24 authors. Cloth. Pp. 371. Price, $6.50. W. B. Saunders Company, Philadelphia, 1951.

The contents of this book originally comprised a series of lectures given for the American College of Physicians which were designed to acquaint the average physician with the rapidly developing specialty of physical medicine and rehabilitation. The majority of the contributors are members of the staff of the Mayo Clinic; however, a considerable number are physicians from other outstanding centers of physical medicine and rehabilitation throughout the country.

The book is divided into four sections: (1) therapeutic application of physical agents and procedures; (2) diagnostic applications of physical agents and procedures; (3) clinical aspects of physical medicine and rehabilitation; and (4) fundamentals of anatomy, therapeutic exercise and physiology as related to physical medicine and rehabilitation. It is difficult to select any particular chapters for special comment because there are so many excellent chapters in this exceedingly well written and well edited volume. The chapter by Dr. Gordon M. Martin entitled "Prescription Writing in Physical Medicine," deserves wide circulation and should be required reading for physicians and medical students. The chapters by Dr. W. Henry Hollinshead on functional anatomy are worthy of special commendation. In general, the illustrations are well selected and reproduced; one might, however, question the advisability of outdoor bicycling as a home activity for patients afflicted with rheumatoid arthritis (fig. 25).

This volume presents an authoritative and much needed summary of current concepts and trends within the specialty of physical medicine and rehabilitation. It should be read by every physiatrist and should be available for reference to every physician, medical student, and physical and occupational therapist who treats patients requiring physical medicine or rehabilitation procedures. This book is a credit to its editor and its contributors and undoubtedly will take its place as a standard reference in physical medicine and rehabilitation.

PHYSICAL MEDICINE AND REHABILITATION FOR THE AGED. By *Walter S. McClellan,* M.D., Medical Director, The Saratoga Spa, Saratoga Springs, New York, Associate Professor of Medicine, Albany Medical College, Albany, New York. Fabrikoid. Price, $2.00. Pp. 81, with illustrations. Charles C Thomas, Publisher, 301-327 East Lawrence Avenue, Springfield, Illinois, 1951.

This concise monograph is divided into nine sections, including an introduction which gives definitions and discusses the scope of the problem: sections on physiologic changes, descripscription of physical agents, prescription writing for physical medicine, programs, applications of physical medicine in specific medical conditions, rehabilitation of the aged, occupational therapy for the aged and conclusions.

With his usual erudition, Dr. McClellan has presented in clear and precise fashion a plea for the intelligent application of physical medicine and rehabilitation in management of the disabilities which are being seen ever more frequently in our aging population. He offers distinct encouragement for the physician who may have become discouraged in attempts to deal with the many medical problems of the aged. At the same time, he points out that it is important to balance physical medicine in relation to drug therapy, dietotherapy, psychotherapy and other forms of therapy. It can be agreed that, as Dr. McClellan points out, "physical medicine has a real place in preventing the development of many conditions in the aged patients, as well as aiding in their control and relief when they have developed." This concise monograph is highly recommended.

PRIMARY ANATOMY. By *H. A. Cates,* M.B., Professor of Anatomy and Director of the School of Physical and Health Education, University of Toronto. Second edition. Cloth. Price, $6.00. Pp. 344, with 405 illustrations. The Williams & Wilkins Company, Mt. Royal and Guilford Aves., Baltimore 2, 1951.

This book is a very good compend of anatomy. It gives the essentials simply and clearly. It is obviously written for students of physical education, physical therapists and occupational therapists. However, it is a good reference book for physicians in physical medicine and rehabilitation and in orthopedics. It is well organized. It is brief (to a fault in a few places). It is illustrated by line drawings similar to those of Grant's Method of Anatomy, third edition. These illustrations are especially clear for one studying functional anatomy.

The description of the function of muscles is good. However, many times the reader may be disappointed by the fact that the author is not sufficiently exhaustive in describing the possibilities of functions of many important muscles. One might disagree as to the function assigned to some muscles in the light of new studies. Some of the systems, such as the genitourinary and digestive, are very briefly covered, which is as it should be if the purpose of the book is for use in teaching ancillary groups. However, the chapter on the nervous system, which covers the whole central nervous system, is perhaps a little lacking in completeness for teaching physical therapists particularly. The book is divided into twelve chapters. The first chapter is a very brief review of histology. The other chapters cover the various systems, namely, the skeletal, articular, muscular, digestive, respiratory, urinary-generative and reproductive, circulatory and nervous systems, eye and ear, skin and endocrine glands.

CONSTRUCTIVE USES OF ATOMIC ENERGY. Edited by *S. C. Rothmann.* Cloth. Price, $3.00. Pp. 258 with illustrations. Harper & Bros., 49 E. 33rd St., New York 6, 1949.

Although we read so much in the public press and current magazines about the destructive force of atomic energy, this book endeavors to call attention to its peaceful uses. The author reviews applications of nuclear energy in fields of industrial power, chemistry, metallurgy, aviation, ceramics, soil-fertilizer, biology, pharmaceutical and medical research.

The first chapter is prepared by Arthur H. Compton, on Atomic Energy as a Human Asset. The second chapter by L. W. Chub is entitled, The World Within the Atom — a simple but accurate explanation of the physics within the atom. Samuel K. Allison wrote the third chapter on Atomic Energy in Industry and the Physical Sciences. This chapter tells how the isotopes are formed and deals with several methods by which tagged atoms can be used in research. The fourth chapter, "Industrial Applications of Radioactivity," by M. Blau and J. R. Carlin, explains many technical uses of radioactive materials. There follow chapters by H. Etherington (Atomic Power for Industry); Alan P. Schreiber (Chemical Process Control with Radioactivity); E. S. Kopecki (Radioactive Traces in Metallurgical Research); Andrew Kalitinsky (Atomic Engines for Aircraft); A. L. Johnson (Ceramics and Nucleonics); F. W. Parker (Radioactive Materials in Soil-Fertilizer Research); G. C. Butler (The Uses of Tracers in Biology); C. P. Rhoads (The Medical Uses of Atomic Energy); John E. Christian (Radioactive Tracer Techniques in Pharmaceutical Research); and G. Failla (Nuclear Physics and Medical Research).

Finally, the book contains an appendix, which is a glossary of some of the important scientific terms used in atomic energy.

All in all, this book, although a compilation of papers of important authors, serves a distinct purpose in bringing the commercial and technical applications of radioactivity into one volume, set forth in terms which the average intelligent person can understand.

THE ELECTRICAL ACTIVITY OF THE NERVOUS SYSTEM: A TEXTBOOK FOR STUDENTS. By *Mary A. B. Brazier,* B.Sc., Ph.D. (London), Neurophysiologist, Massachusetts General Hospital Research Associate, Harvard Medical School. Cloth. Price, $5.00. Pp. 220, with 96 illustrations. The Macmillan Company, 60 Fifth Ave., New York 11, 1951.

Doctor Brazier is to be congratulated on the admirable presentation of her subject in this small but adequate textbook. The author states that the book is written for students with the purpose of bringing together under one cover a survey of the electrical activity of the nervous system. The author has been most discriminating in the selection of material and hence the objective has been reached with marked distinction.

The text is divided into eighteen chapters, each ending with an excellent list of references for further study. The writer states that the book is not intended to be a technical manual. Technical methods are constantly changing with the development of instrumental design and therefore would soon be superseded. The place to learn technique, says Doctor Brazier, is in the laboratory. A partial list of the chapters includes an outline of the physiology of the nervous system; the electrical change associated with nervous activity in axons; action potentials in nerve; the excitability of nerve; the compound action potential of nerve trunks; the propagation of the nerve impulse; transmission of synapses; the electrical potential of the spinal cord; the electrical response to stimulation of sense organs; cortical response to peripheral stimulation; the electrical activity of the brain; and the electroencephalogram of man. The text closes with an adequate index.

For those physicians who wish a thorough groundwork for electromyography or encephalography this text is highly recommended.

THE SCIENTIFIC PAPER:. HOW TO PREPARE IT, HOW TO WRITE IT, A HANDBOOK FOR STUDENTS AND RESEARCH WORKERS IN ALL BRANCHES OF SCIENCE. By *Sam F. Trelease.* Second edition. Cloth. Price, $2.50. Pp. 163, with 8 illustrations. Williams & Wilkins Co., Mt. Royal and Guilford Aves, Baltimore 2, 1951.

In reviewing such a manual as this excellent treatise on the preparation and writing of a scientific paper, one is haunted by the phrase, vade mecum. So why not yield to the temptation to say that it is to be highly commended as a monitor and companion for any scientist faced with the necessity or urge for publication — from the budding Ph.D., collecting his first 3 by 5 cards, to the seasoned researcher needing help in a detail of writing not encountered before or a reminder on customary usage or procedure The handy pocket size of the book represents an additional convenience.

The first two chapters, "The Research Problem" and "Writing the Paper," give invaluable advice to the beginner as to collecting, organizing and actually writing up his material. This part might well be supplemented by instructions for an actual visit to a printer's and to an engraver's shop with details as to what the neophyte writer should know about the mechanics of putting his words, tables, and illustrations onto the page where they will finally appear. It is assumed that the veteran researcher will long since have made such visits.

The clarity, brevity, and accessibility of the material in the first two chapters continues throughout the remainder of the text, complemented by an excellent index. The book is intended for the scientific writer in general and is entirely adequate as a basic aid for a medical writer, but to meet the latter's special needs should be supplemented by such a text as Fishbein's classic Medical Writing.

POSTURE AND PAIN. By *Henry O. Kendall,* Director, Physical Therapy Department; *Florence P. Kendall,* Assistant Director, Physical Therapy Department, and *Dorothy A. Boynton,* Physical Therapist, Physical Therapy Department, Children's Hospital School, Baltimore, Maryland. Cloth. Price, $7.00. Pp. 213, with 159 illustrations. The Williams & Wilkins Company, Mt. Royal and Guilford Aves., Baltimore, 1952.

The diagnosis and treatment of postural defects and the resultant symptoms constitute an important aspect of the practice of physical medicine and orthopedics. The evaluation of good or of faulty posture and the concomitant muscular contractures and weaknesses is dependent on careful physical examination. This is best presented with as much visual material as possible. One of the most valuable aspects of this book, which makes it superior to other publications on the subject, is the fine collection of photographs and two-tone line drawings.

The material presented is based on the large experience gained from careful study of muscular function by the authors, physical therapists, who have studied over 12,000 cases. Explanations as to the cause of symptoms are based largely on the thesis of mechanical trauma rather than pathophysiologic and histologic changes which, of course, are not known in the majority of instances.

Treatment is prescribed and in much more detail and more dogmatically than usual when given by a physician or surgeon. The results of treatment are not analyzed, although success is inferred. Differential diagnosis is largely omitted and little is said about the value of examination by a doctor or about x-ray or laboratory studies.

In spite of these defects and possible dangers, one must admit that this is an excellent presentation of the study of good and faulty posture and its correction. It should be welcomed by teachers and students in physical therapy, physical medicine, orthopedics, and also the general practitioner, pediatrician, and physical educator.

PHYSICAL MEDICINE ABSTRACTS

The Use of Intravenous Mephenesin (Tolserol®) in Physical Medicine: A Clinical and Laboratory Study. Sedgwick Mead; Emily E. Mueller, and Alex Harell.

Brit. J. Phys. Med. 14:223 (Oct.) 1951.

As a result of clinical and laboratory study on the use of intravenous mephenesin (Tolserol®) in 38 patients complaining of low back pain or painful shoulders with limited movement, we have come to the following conclusions: The intravenous use of mephenesin is a valuable analgesic and aid to certain physical medicine procedures for a limited group of patients. The oral ingestion of mephenesin does not appear to have much effect on the relief of pain. Intravenous mephenesin is more effective in acutely painful, severely disabling conditions than in chronic states with severe contractures and those manifesting little or no pain. Laboratory studies do not support the thesis that pain relief occurs by relaxation of muscle spasm or by elevating the pain threshold. There is some evidence that such relief of pain may result from relaxation of vasospasm.

Combined Bone and Nerve Injuries. William J. Tobin.

Mil. Surgeon 109:621 (Nov.) 1951.

This paper is concerned primarily with the reconstructive phase of the surgical treatment of cases of combined nerve and bone injuries. In the type of cases discussed, it is assumed that infected wounds have healed, adequate skin coverage has been attained, and so forth. Those cases of peripheral nerve lesions associated with fractures constitute by far the majority requiring the cooperation of the neurosurgeon and the orthopedic surgeon. Many of these cases are admitted wearing plaster casts on the involved extremity. Upon removal of the cast, very few are ready for their definitive surgery. An unavoidable handicap from the surgical viewpoint is cast stiffness of muscles, ligaments and joints due to the prolonged immobilization incidental to the treatment of the fracture. Physical therapy in the form of massage, radiant heat, active and passive motion, is a valuable asset in preparing these patients for their definitive surgery. Both the soft tissues and bones in these cases show a disuse atrophy of varying degrees. Mobilization of the extremity as much as possible, depending on the nature of the fracture, and early physical therapy improve the general condition of the extremity and further insure a better postoperative result. Occupational therapy with its emphasis on active motion is a valuable adjunct in improving these cases. This is particularly useful in the hand where stiffness of the small joints is marked and at times resistant to treatment. Mechanical supportive measures such as cock-up splints for wrist drop from radial nerve paralysis and some type of a drop foot brace for peroneal nerve paralysis should be used whenever indicated. Highet emphasizes the importance of splinting paralyzed muscles to prevent stretching. When reinnervation does occur in a stretched muscle, there is less functional recovery than in a protected muscle. Over-splinting by rigid, inmovable splints is more harmful than no splinting at all, however. The splint should be one that can be removed to permit proper physical therapy and occupational therapy. Early mobilization of joints is an essential preliminary step in the treatment wherever and whenever possible. For facility and comfort in transportation, plaster casts are unquestionably indicated and necessary. Too often, however, plaster immobilization is permitted to remain on the extremity longer than is really necessary. In femoral shaft fractures, the cast should be removed on admission and the extremity put up in a balanced type of traction with or without skeletal traction as the nature and status of the fracture demand. The same principle applies in upper extremity fractures.

Bilateral Ulnar Nerve Palsy as a Result of Pressure Phenomena. Jose Saez, and Irwin D. Stein.

Arch. Int. Med. 88:512 (Oct.) 1951.

Isolated peripheral-nerve paralysis is common and is most frequently caused by trauma. Multiple peripheral nerve lesions, particularly when symmetrical, are generally ascribed to the effects of some toxin or systemic disease, such as alcoholism, diabetes, or a demyelinating process or virus infection of the central nervous system. In the case described in this report, the initial impression of the ulnar nerve palsy, which appeared bilaterally and simultaneously, was that it was a cervical lesion, either in the spinal cord or in the vertebral column. However, roentgenograms of the elbows revealed peculiar bony deformities. The discovery of these bony deformities led to the belief that in some manner they were connected with the appearance of the paralysis. The patient was twenty-five years of age. His complaints were numbness, tingling, weakness, and atrophy in the distribution of the ulnar nerve of each hand. At the age of twelve the patient had fallen against a fence with his right elbow being injured. Three weeks later he fell from a chair and struck a table with his left elbow. After thorough examination, exploration and transposition of the right ulnar nerve was undertaken. When the patient soon began to manifest improvement in sensation and to have better use of his right hand, operation was performed on the left ulnar nerve. The post-operative course was uneventful, there being rapid and striking improvement in both motor and sensory function.

About six weeks after operation, the left hand was practically normal, except for slight diminution in sensation to touch in the fifth finger and along the outer aspect. On the right side, sensory function was gradually returning, but there was still weakness of the interossei and the adductor of the thumb. Throughout the entire postoperative period the patient was treated by means of electrical stimulation and active use of his fingers and hands in physical and occupational therapy.

Theory of Reflex Controls to Explain Regulation of Body Temperature at Rest and During Exercise. H. C. Bazett.

J. Applied Physiol. 4:245 (Oct.) 1951.

The apparently paradoxical relationships of the mechanism of temperature regulation at rest in a warm environment are contrasted to those during work. The first condition imposes its load as heat of external origin, the second that of internal origin. At rest as the ambient temperature rises, the first line of defense against overheating is the change occurring in the peripheral blood flow. Sweating does not supervene until the skin temperature normally reaches roughly 34.5 C. During work, such as exercise, sweating occurs at variable, even relatively low; skin temperatures. The skin temperature during work is closely related to the environmental temperature and is regulated by sweating in spite of a rectal temperature which rises in direct proportion to the intensity of the work. The problem lies in the need for an adequate explanation of the afferent stimulus for sweating. The second aspect of the problem lies in the accounting for such a regulation of rectal temperature by dermal sensory receptors apparently prone to adaptation. This difficulty is dealt with by a consideration of the probable spread of thermal charges to involve other adjacent vascular and receptor pathways. The evidence and logic are recounted which led the author to believe that reflex responses to both heat and cold exist and that the dermal receptors mediating these reflex responses are stimulated by temperature gradients. The established superficial receptors for heat and cold (Ruffini's and Krause's, respectively) lie adjacent to and likely between venous and arterial plexuses. The author cites evidence for his belief that a second heat receptor lies deeper at the level of the subcutaneous junction. This receptor, he postulates, lies in the same relationship with respect to deeper adjacent arterial and venous plexuses. It has been shown that marked temperature differences may exist between arterial and venous blood which would affect changes in the thermal gradients adjoining these vessels. The superficial heat receptors and their adjacent vessels are affected mainly by external heat, the deeper ones by internal heat from working muscles. The theory assumes that the superficial heat receptor is concerned with vascular readjustments induced by external heat and that the deeper heat receptor is concerned with sweating and is stimulated readily by internally produced heat. The apparent relationship of sweating to skin temperature, the author believed, is due to thermal gradients. The relationships of blood flow and temperature affecting these changes in exercise and at rest are discussed. Based upon such a hypothesis, the author believed that sweating rates could be predicted over a wide range of environments and metabolic rates.

The Organization of In-Patient Rehabilitation at the Royal Air Force Medical Rehabilitation Unit, Headley Court. P. J. R. Nichols.

Brit. J. Phys. Med. 14:219 (Oct.) 1951.

A basic remedial program must be both rigid and elastic. This paradox is logical when you consider the commitments. It is essential to have thoroughly organized and rigid time-tables for remedial class-work, and equally important to cater for the variations and individuality of each patient. The main division of the patients is according to the severity of the disability. The patients who require individual supervision are treated almost entirely by the physical therapists. These are mostly cases of severe paralysis following anterior poliomyelitis, or multiple injuries in the early stages. The actual time-table is built up of half hour periods preceded morning and afternoon by half hour general "loosening-up" or "warming-up" physical therapy. The total remedial program for each patient consists of four to five hours per day, depending on the stage of recovery. This includes all activities, exercises, games, physical therapy, hydrotherapy and occupational therapy. Great emphasis is laid on the team spirit; close understanding and cooperation between physician, physical therapist, physical training instructor, and patient are essential for good rehabilitation. Specialization is the logical outcome of increasing knowledge. In medicine, specialization tends to reduce the physician-patient relationship to a formal consultation. I believe that rehabilitation, with its attempt to treat the physical, mental and social effects of disability, may help to restore the medical profession to the status of guide, philosopher and friend.

Electrodiagnostic and Electromyographic Study of Muscle Denervated by Section of the Anterior Roots. Norman B. Dobin, and James A. Fizzell.

Quart. Bull., Northwestern Univ. M. School 25:338 (Winter) 1951.

The kinetics of stimulus of a muscle in its normal state as well as in a state of denervation by peripheral nerve section was studied both in man and animals by means of the constant current impulse stimulator and was reported by Pollock and his associates. In these instances of peripheral nerve sections, both sensory and motor supplies to the muscles were interrupted. The present study deals with the kinetics of stimulus of a muscle whose motor supply was interrupted while the sensory supply remained intact. This state was produced in experimental animals (seven cats) by sectioning the anterior roots of the spinal cord supplying the lower extremity while leaving the corresponding posterior roots intact. Observations were then made upon the tibialis anticus muscle over a ninety-day post-operative period with the following results: The rheobase threshold falls, reaching its lowest level on the twenty first post-operative day, and then gradually rises but does not reach the original value by the ninetieth day. The chronaxie becomes lengthened. The cathodal tetanus ratio falls and reaches unity on the twenty-first post-operative day. The strength-interval curve for repetitive stimuli of one millisecond duration becomes ascending in the direction of the greater time interval between stimuli, and the threshold for twitch and tetanus to repetitive stimulation approach equality. The strength-duration curve develops discontinuities as early as the seventh and retains these as late as the ninetieth postoperative day. Spontaneous fibrillary activity recorded electromyographically is represented by electrical potentials of an amplitude ranging between 25 and 80 microvolts and having durations of 1 to 2 milliseconds. These findings are considered to be evidence of nerve degeneration and muscle denervation in anterior root sections where it was known that the sensory branches were intact. They parallel the accepted clinical neurological evidence of a lower motor neuron lesion. These findings also parallel the kinetics of stimulus of denervated muscle in instances of peripheral nerve lesions where it is known that both motor and sensory pathways are interrupted.

Comparative Morbidity of Early and Late Ambulation. Eugene Todd, Jr., and Francis M. Massie.

J. Kentucky M. A., 49:401 (Sept.) 1951.

"Early ambulation" means getting the patient out of bed and walking, not sitting, as soon as practicable. To be effective it must be worked at by both the patient, the physician, and especially the nursing staff in charge, and it must be walking. A comparison has been made of the morbidity rate of patients before and after the introduction of early ambulation as part of their postoperative treatment. A study of the major postoperative complications both by age groups and by operative procedures done has been presented. The study was made from 1727 consecutive private patients who had had major abdominal, radical breast, or goiter operations. Patients less than 20 years of age were omitted from the study. The authors reached the following conclusions:

(1) Thrombophlebitis has not been reduced by the use of early ambulation;

(2) pulmonary complications are reduced to a gratifying extent by the use of early ambulation;

(3) cystitis has been reduced by about one-half;

(4) the incidence of wound dehiscense showed no change between the control and the ambulatory group;

(5) the incidence of generalized peritonitis is little changed by ambulation and the reduction of 0.28 per cent in this study probably can be accounted for by the use of antibiotics in those cases in which it was feared pre-operative or operative contamination had occurred;

(6) the total morbidity has been reduced by 5.4 per cent which is certainly significant. Most of this is accounted for in the reduction of pulmonary complications;

(7) the total death rate was not significantly changed, and

(8) the abstract but nonetheless very important psychological outlook of the patients treated by early ambulation is of very great value. These patients soon obtain confidence in their future welfare. They need fewer narcotics and their general discomfort does not last nearly as long. Strength is regained quickly and the hospital stay is reduced .

Primary Involvement of the Upper Extremities in Thromboangiitis Obliterans. Eugene M. Farber, and Millard H. McLain.

Arch. Dermat. & Syph. 64:352 (Sept.) 1951.

Thromboangiitis obliterans (Buerger's disease), limited primarily to the upper extremities, is rarely seen. Recently two patients were observed with this disease of the upper extremity, neither of whom had clinical evidence of involvement of the lower extremities. In both patients painful ischemic ulcers of the finger tips developed. The lesions became infected and were treated as pyodermas until underlying vascular disease was recognized. In typical cases of thromboangiitis obliterans, 40 per cent of the patients suffer from arterial disease of the upper extremities in association with occlusive arterial disease of the lower extremities. It is unusual for the disease to develop in the hands clinically before there are symptoms referable to the legs. Constam reviewed the clinical findings of 94 patients with the disease and reported that in four of this group signs and symptoms of thromboangitiis obliterans of the upper extremities develop before the lower extremities were involved. The diagnosis of thromboangitiis obliterans of the digital type was made in these two cases on the following evidence: organic occlusion of a medium-sized artery, Raynaud's phenomenon, intermittent pain of the hands, and presence of superficial painful ulcers. Early recognition of this disease as a cause of ulceration of the digits of the hands is important because early recognition with adequate treatment may prevent the loss of a finger or a limb.

Early Recognition of Peripheral Nerve Injuries. Anielio F. Mastellone.

U. S. Armed Forces M. J. 2:1523 (Oct.) 1951.

The prompt recognition of incidental nerve lesions is essential to total recovery and their presence should be recorded when recognized. The absence of nerve lesions at the point of injury is equally important and should likewise be noted. Early treatment of peripheral nerve lesions should not be allowed to interfere with saving life or limb but is required to prevent serious sequelas, often irreversible, such as contractures, stiffness and fibrosis of joints and muscles. Until such time as the patient arrives at a point in the chain of evacuation where definitive treatment can be administered, it is important to support the involved part. For the upper extremity a simple sling may give sufficient support to prevent stretching of the paralyzed parts. A simple footdrop splint may be all that is necessary in the lower extremity to preserve functional position. Contractures of muscles and tendons and stiffness of joints may be prevented by frequent passive movement of the involved parts through a full range of motion. If possible, the patient should be instructed to do this for himself.

Physiological Responses of Hands and Feet to Cold in Relation to Body Temperature. C. H. Wyndham, and W. G. Wilson-Dickson.

J. Applied Physiol. 4:199 (Sept.) 1951.

Freeman and Nickerson demonstrated that when a naked man is exposed to low air temperatures his extremities cool more rapidly than the rest of the body. This is due mainly to a reduction in the heat input to the hands and feet. Such reduction in heat input has been shown to be due to one or more of the following causes: (a) direct action of cold on peripheral blood vessels; (b) reflex sympathetic constrictor activity in response to general body cooling; or (c) precooling of arterial inflow by venae comites. Apart from reduced heat input, hands and feet may be expected to cool more rapidly than other parts because of their greater surface area/mass ratio; this factor may also react on (a) above so as to enhance its effect. Cold-weather clothing designed for practical conditions must avoid undue bulk and must not cause overheating during heavy exercise, hence its insulation is usually such that exposed men thus clad will show some body cooling during periods of rest. Under these conditions marked cooling of hands and feet may again be expected, due to the operation of the above factors together with the fact that it is not possible to provide as good insulation on hands and feet as elsewhere without making them unacceptably clumsy. Subjects in full protective clothing, exposed in 3-hour experiments at sea to ambient temperatures down to —12 degrees C. with varying wind, showed rapid and marked cooling of hands and feet during rest periods when the body was cooling generally to some extent. The process appears to be similar to that operating in the previously known rapid cooling of extremities of naked subjects in the laboratory. Hands and feet after cooling thus to the point of discomfort and loss of efficiency consistently rewarmed when body heat content was restored as a result of comparatively light physical work. Thus the reflex control of blood flow appears to exert a dominating effect on extremity temperatures in cold. Some apparent reinforcement of the vasodilator effect was shown in short exposures with the body heavily clad and body temperature raised by vigorous work, when even bare hands were prevented from cooling. With the body scantily clad, even raised rectal temperature did not prevent some hand cooling; possible reasons for this are suggested.

New Technique for Local Treatment of Burns. Raymond M. Curtis; John H. Brewer, and Ira W. Rose, Jr.

J. A. M. A. 147:741 (Oct. 20) 1951.

A new method for the treatment of burns and wounds is suggested. It is comprised of a partially hydrolyzed casein gel which is applied to the burned area and is then covered with gauze impregnated with zinc acetate. The gel is set, forming a semipermeable membrane which prevents the superficial protein loss, and, by the support given the damaged capillary bed, diminishes the protein loss into the burned area, thus minimizing local cellular damage and shock. There is relief of pain, a minimum of infection, and a splinting of the injured part. This method of treatment permits early grafting by allowing the body's own enzymatic and phagocytic systems to debride the area of deep burn. The method which is described is simple and easy to apply and can be used by untrained personnel.

A Sectional Leg Splint. Burdick G. Clarke.

U. S. Armed Forces M. J. 2:1519 (Oct.) 1951.

The high frequency of extensive soft tissue wounds and of compound fractures of the legs is well recognized in modern warfare. To minimize shock and soft tissue damage it is necessary to splint these limbs early. The hinged, half-ring leg splint, known variously as the Kellar-Blake splint or the half-ring Thomas leg splint, is a standard appliance for this purpose in the Armed Forces. Because this indispensable item is four feet long, it is difficult to transport in ground warfare, and too large for convenient stowage aboard ships or aircraft. To overcome these disadvantages, a folding sectional modification of the standard splint has been designed. Photographs and specifications for its construction are given. It is proposed that this item be listed as expendable, to be discarded when the patient's movement to the rear permits definitive treatment.

The Cerebrovascular Accident: A Review of Some Pathological and Clinical Problems. A. Theodore Steegmann.

J. Kansas M. Soc. 52:473 (Oct.) 1951.

The treatment of a cerebrovascular accident must be approached as an individual problem. It is an advantage to be familiar with the symptoms and condition of the patient preceding a stroke, an advantage the family physician may have over the specialist. We cannot be certain, but it seems probable that weight reduction, particularly in hypertension, avoidance of strain and excitement and a more leisurely life may delay, if not prevent, a stroke in some cases. Certainly cardiac reserve, kidney sufficiency, and the average level of the blood pressure are important considerations in treatment. Many arteriosclerotic patients seem to live more happily and comfortably when treated with regular doses of caffeine, phenobarbital, and nicotinic acid, or other vasodilators. Steegmann is convinced that a large percentage of patients who have strokes do not get the best medical management. The patient with a cerebral hemorrhage is going to suffer from shock and cerebral tissue injury, and his fate will be determined by the site and degree of hemorrhage regardless of the treatment employed. In patients with thrombosis, the same initial procedures as used in the treatment of cerebral hemorrhage are employed, and early ambulation, muscle reeducation, and exercise will restore many to useful lives. Before the ambulant stage, contractures of muscles and fibrous ankylosis of the joints of the paralyzed limbs can be prevented by daily passive motion, stretching and massage. The prognosis, in general, is better in patients with encephalomalacia, but the site and extent of the lesion will determine the outcome. Medical treatment aims towards maintaining good circulation in as much of the ischemic tissue as possible.

Changing Attitude Toward Multiple Sclerosis: A Program of Management. Edward E. Gordon, and Karl E. Carlson.

J. A. M. A. 147:720 (Oct. 20) 1951.

The attitude toward the course of multiple sclerosis is undergoing a change. The "classic" picture has emphasized the rapid progression, the swift onset of helplessness and early death. While such a portrait may apply to an individual case, it appears that the natural evolution, like the symptoms of the disease, is varied, and that many patients do retain usefulness for a long period of time. Moreover, when multiple sclerosis is studied in a group, the survival time appears to have been underrated; one recent statistical study indicates that the median duration of the disease is in the vicinity of 27 years, a surprisingly high estimate in comparison with previous views. No prediction as to immediate course and prognosis is possible in each individual case. Every patient must be given the benefit of the doubt to as liberal an extent as the judgment of the physician can permit. No one can foretell whether a given remission may not be the last, or whether it will not be maintained for many years. To improve the patient's situation, the techniques developed in the field of rehabilitation may be utilized to teach the patient how to live with his residual capacities to the best of his ability. It is generally conceded that physical medicine often is the most useful approach to the management of patients with chronic neurological diseases. This statement should be broadened to include suitable rehabilitative techniques. The application of this branch of medicine is all the more important because of failure of any definitive medical treatment up to the present time. But treatment by default represents only a negative approach. Already mentioned is the necessity for regarding each individual patient as a possible candidate for rehabilitation, since one cannot determine the future course of the disease as regards speed of progression. Another justification for the management of multiple sclerosis by rehabilitative techniques is the advantage of maintaining maximum physical activity. The techniques employed to teach the patient how to live with his residual capabilities may be summarized briefly as follows: strengthening of residual motor units of a muscle which are only partially removed from voluntary innervation but which are atrophied from disuse; training of synergists for a particular motor pattern in which the neuronal connections to the prime mover are affected; training of other muscles to perform movements to substitute for the normal prime movers irreversibly affected, and use of mechanical devices to compensate for disabilities in order to accomplish purposeful motion required for the numerous activities of daily living.

Influence of Autogenous Muscle Sounds on Ergographic Work Capacity. Anna Scott Hoye.

J. Applied Physiol. 4:368 (Nov.) 1951.

The influence of autogenous auditory stimuli on work output was observed on seven normal adult subjects during two series of experiments designed to permit a reliable estimate of functional capacity. These consisted of three weeks of right- and left-sided training based on the limit day procedure adapted for the wrist ergograph with biaural stimulation on alternate days, and variable periods of training during which the exercise was performed exclusively in the over-load zone with auditory facilitation on alternate bouts. A total of 301 experiments were performed. The evidence supports the following conclusions: Auditory stimulation in the form of sounds autogenously developed by the prime mover are perfectly synchronized with the movement producing them, and serve as a cue to the severity of effort; work output is facilitated by autogenously developed auditory stimuli; the facilitatory effect of auditory stimulation is significant only when work approaches maximal capacity.

Indirect Vasodilatation in Normal Man and in Schizophrenic Patients. Austin Henschel; Josef Brozek, and Ancel Keys.

J. Applied Physiol. 4:340 (Nov.) 1951.

Characteristics of the peripheral circulation were studied by skin temperature measurements and by finger plethysmography in clinically healthy persons and in patients with schizophrenia who were judged to be physically healthy. In a general state of vasoconstriction, in a cool room, reflex vasodilatation in the fingers was produced by immersing the feet and lower legs in water at 45 degrees C. The schizophrenic patient, compared with the normal subjects, exhibited a significantly prolonged latent period before vasodilatation began but, once dilatation started, the time course and magnitude of the response was closely similar in the two groups. The characteristics of the pulse waves in the finger were not different in schizophrenics as compared with the "normal" control subjects. It is concluded that there is no evidence for abnormality of the peripheral vessels in schizophrenics but that in such patients there tends to be either an exceptionally high and persistent state of tonus in the skin vessels or an abnormally high temperature threshold in the hypothalamus. These observations provide a basis for the frequent observation of cold and slightly cyanotic skin in schizophrenia.

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ORIGINAL ARTICLES

Studies on Neuromuscular Dysfunction: XV. Herman Kabat, M.D., Ph.D. 521
Discussed by Dr. Harriet Gillette.

The So-Called Bicipital Syndrome of the Shoulder. Robert W. Newman, M.D. 534
Discussed by Dr. J. H. Kuitert.

Therapeutic Teaching. Morton Hoberman, M.D., and Erbert F. Cicenia, M.A., R.P.T. 539
Discussed by Dr. H. Kessler.

Resistive Exercises in the Treatment of Poliomyelitis. Duane A. Schram, M.D. 549

Functional Shoulder and Upper Extremity Brace-Apparatus. Robert B. Wallace, M.D. 553

●

Medical News 556

●

Editorials 557

●

Book Reviews 561

●

Physical Medicine Abstracts 569

●

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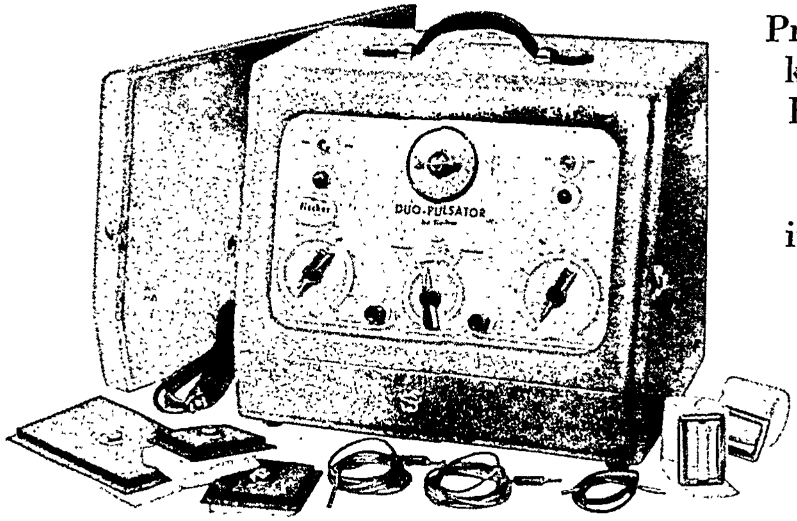

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STUDIES ON NEUROMUSCULAR DYSFUNCTION: XV

The Role of Central Facilitation in Restoration of Motor Function in Paralysis *

HERMAN KABAT, M.D., Ph.D.
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In considering the fundamental aspects of therapeutic exercise for restoration of voluntary motion in patients with paralysis, too little attention is often paid to the paramount role of central mechanisms.[1-2] Once a threshold impulse reaches a group of muscle fibers, the fibers have no choice but to contract. The major determining factors in the response of muscle in voluntary motion reside in the central mechanisms rather than in the muscle itself.

It is well established that the motor unit is the fundamental unit of neuromuscular activity. This consists of the anterior horn cell and its motor nerve fiber, the myoneural junction, and a hundred or more muscle fibers innervated by the single motor nerve fiber. This unit functions "all-or-none." This means that, under ordinary conditions, if the anterior horn cell is stimulated strongly enough to discharge, all the muscle fibers of the motor unit contract maximally. The motor unit either responds to a stimulus as strongly as it can or does not respond at all.[3] The strength of contraction of a muscle, either in voluntary motion or in reflex action, is dependent largely on the number of motor units activated: the stronger the contraction, the larger the proportion of active motor units in the muscle. Another less important factor determining strength of muscular response is the frequency of impulses in the motor nerve.

In treatment of paralysis, activity of the motor units results in therapeutic benefit to the muscle in the form of hypertrophy and to the nervous mechanism in greater ease of impulse transmission. It is reasonable, therefore, to set as the goal of the neuromuscular reeducation program, the excitation of all available motor units of the muscle with each voluntary effort. Each exercise would then have the greatest therapeutic effectiveness, both for the muscle and its nervous mechanism. Once the anterior horn cells fire, the associated muscle fibers of their motor units discharge maximally, as a rule, so that the beneficial effects on the muscle follow automatically. The focus of the program must therefore be maximal excitation of the anterior horn cells through central motor mechanisms.

How can one bring about maximal excitation of the motor units of a muscle with each voluntary effort? Since the function of each motor unit under ordinary conditions is automatic and invariable in a maximal response, the number of excited motor units in a muscle must depend on the bombardment of the anterior horn cells with impulses from the motor mechanisms in the central nervous system. In voluntary motion, the primary discharge is from the motor cortex through the corticospinal tract and the internuncial neurons to the anterior horn cells. However, the response is also influenced to a considerable extent by the level of excitation at synapses on the motor

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* Read at the Twenty-ninth Annual Session of the American Congress of Physical Medicine, Denver, Colo., Sept. 8, 1951.

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[2] Wakim, K. G.. The Physiologic Aspects of Therapeutic Physical Exercise, J. A. M. A. 142: 100, 1950.

[3] Fulton, J. F.: Physiology of the Nervous System, Oxford University Press, New York, 1943.

neurons resulting from proprioceptive and postural reflexes and efferent discharges from the cerebellum, basal ganglia and brain stem. The importance of summation of subthreshold stimuli and of facilitation in the central nervous system in determining the strength of reflex response is well established.[3] A stimulus to the anterior horn cells excites some motor neurons to exceed their threshold and discharge impulses, while many other anterior horn cells reach a level of excitation below threshold and fail to fire. The latter anterior horn cells are the "subliminal fringe." [3] Summation of the subthreshold excitation with stimulation from other sources (facilitation) brings the level of excitation of these neurons up to threshold and enhances the motor response by recruiting additional motor units to activity. Central facilitation is essential for maximal excitation of the motor units in voluntary motion.

For a number of years we have applied a variety of facilitation techniques in treatment of paralysis in order to bring about maximal excitation of the available anterior horn cells.[4 5 6-7-8-9-10] The techniques of central facilitation which we have employed in treatment of paralysis include:

(1) Maximal resistance.
(2) Stretch
(3) Mass movement patterns.
(4) Reflexes.
(5) Reversal of antagonists.

The therapeutic program has been applied in the treatment of thousands of patients with a variety of types of paralysis at the Kabat-Kaiser Institute without demonstrable harmful effects and with excellent recovery of motor function.[4 5 6-7-8-9-10-11-12]

One might expect that, with the patient exerting the greatest possible effort in voluntary contraction of a muscle against maximal resistance, it would be certain that a maximal response would ensue. This is not true, however, and one can readily demonstrate a considerably greater motor response from employing facilitation mechanisms in addition to resistance. This phenomenon can be demonstrated most strikingly in the response of "zero" muscles. In many cases of poliomyelitis as well as in patients with upper motor neuron lesions, we have found muscles which failed to give any response on voluntary effort in free motion and which also failed to give any response when an attempt was made to contract the isolated muscle against maximal resistance. This "zero" muscle, however, showed a definite response when other facilitating mechanisms were employed and summated to bring about greater excitation. For example: A peroneal muscle which failed to respond at all in attempted isolated free motion or against resistance, definitely contracted with the application of stretch and voluntary effort in a mass movement pattern of extension and abduction of the hip against resistance.[5-7 9] In the example of such a "zero" muscle, there can be no question that facilita-

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[4] Kabat, H Studies on Neuromuscular Dysfunction, X Treatment of Chronic Multiple Sclerosis with Neostigmine and Intensive Muscle Re education, Permanente Foundation Med Bull 5:1 (Mar.) 1947

[5] Kabat, H Studies on Neuromuscular Dysfunction, XI New Principles of Neuromuscular Re education, Permanente Foundation Med Bull 5:111 (Nov.) 1947

[6] Kabat, H Studies on Neuromuscular Dysfunction, XII Rhythmic Stabilization, a new and More Effective Technique for Treatment of Paralysis Through a Cerebellar Mechanism, Permanente Foundation Med Bull 8:9 (Jan) 1950

[7] Kabat, H Studies on Neuromuscular Dysfunction, XIII New Concepts and Techniques of Neuromuscular Reeducation for Paralysis, Permanente Foundation Med Bull 8:121 (July) 1950

[8] Kabat, H Studies on Neuromuscular Dysfunction, XIV Restoration of Voluntary Motion and Sensation Through Neuromuscular Reeducation in Apparently Complete Traumatic Paraplegia, Permanente Foundation Med Bull 9:86 (July) 1951.

[9] Kabat, H. Central Mechanisms for Recovery of Neuromuscular Function, Science, 112:23 (July 7) 1950

[10] Kabat, H , and Rosenberg, D Concepts and Techniques of Occupational Therapy for Neuro muscular Disorders, Am J Occup Therapy 4:6 (Jan -Feb) 1950.

[11] Cailliet, R The Rehabilitation Treatment of Multiple Sclerosis and Its Rationale, Occup Therapy 29:1 (Feb) 1950

[12] Huddleston, O. L · Use of an Intensive Physical Medicine Program in the Rehabilitation of Convalescent and Chronic Anterior Poliomyelitis Patients, Arch. Phys Med., 1952 (in press).

tion was essential to bring about a response by raising the level of excitation above threshold for the anterior horn cells, since no response at all occurred with a lower level of facilitation of these dormant motor neurons, despite the greatest effort on the part of the patient. An increased response above that obtained by resistance alone can also be demonstrated from application of additional facilitating mechanisms in muscles only partially paralyzed and even in normal muscles.

Strong confirmatory evidence for the importance of central facilitation in increasing motor unit activity in voluntary motion is presented in the experimental work of Gellhorn.[15] He demonstrated the powerful effect of proprioceptive facilitation through resistance, stretch and mass movement patterns in increasing the number of motor units in the muscle excited by electrical stimulation of the motor cortex in the monkey. In a chapter in his forthcoming book,[13] Gellhorn points out that such techniques of central facilitation are essential for an effective program of neuromuscular reeducation for paralysis.

Hellebrandt, et al.[14] demonstrated a significant effect of central facilitation in normal subjects in increasing work capacity and decreasing fatigue. The wrist extensors were contracted rhythmically against resistance in ergographic experiments. The work capacity of the right wrist extensors was definitely greater when the muscles were exercised bilaterally than when they were exercised unilaterally. Augmentation in work output was greatest when the exercise was performed by alternately contracting the right and left wrist extensors. The bilateral exercise not only increased the immediate response but was effective in overcoming fatigue from unilateral exercise. It was shown that active recuperation, accompanied by central facilitation, was more effective in eliminating fatigue than was passive recuperation.

The most important fundamental work on central facilitation in motor mechanisms was carried out by Sherrington and his co-workers.[3] In a striking experiment on monkeys, Mott and Sherrington[15] demonstrated that elimination of proprioception from a limb by deafferentation results in complete and permanent paralysis of voluntary motion of that limb. Since voluntary motion is practically impossible after deafferentation of a limb, although the response to cortical stimulation is relatively unimpaired, proprioceptive impulses must be considered the essential afferent arc in performance of voluntary motion. Sherrington also demonstrated the principle of successive induction,[3] showing that immediately after excitation of the antagonist muscle, the agonist was facilitated. This principle has been applied in our facilitation technique of reversal of antagonists.

The usual procedure in treatment of paralysis is to follow a routine of physical therapy starting with passive motion and progressing gradually through assistive motion, free motion with gravity eliminated, and free motion against gravity to resistive technique.[1] Emphasis is placed on avoidance of fatigue and prevention of stretch of the affected muscles. This procedure is applied in voluntary contraction of isolated single muscles or single motions with rigid exclusion of activity of other muscles.[1] These techniques have until recently been accepted without question as the most effective approach to neuromuscular reeducation. Some investigators have advocated earlier and more intensive use of resistive exercise and these procedures are becoming more widely accepted.[16-17] However, no thorough theoretical analysis of the effectiveness of resistance has been presented by these investigators.

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[13] Gellhorn, E.: Restitution of Movement After Central Lesions, Oxford University Press (Chapter in book in press).

[14] Hellebrandt, F. A.; Houtz, S. J., and Eubank, R. N.. Influence of Alternate and Reciprocal Exercise on Work Capacity, Arch. Phys. Med. 32:766 (Dec.) 1951.

[15] Mott, F. W., and Sherrington, C. S.: Experiments Upon the Influence of Sensory Nerves Upon Movement and Nutrition of the Limbs, Proc. Roy. Soc. 57:481, 1895.

The generally accepted program of neuromuscular reeducation places great emphasis on avoidance of excessive activity, with much of the time spent in passive and assistive exercise and with concentration on avoidance of fatigue. This technique fails to activate all of the available motor units of the muscle and is therefore not fully effective in the therapy of paralysis. Electromyographic studies of normal and paralyzed muscles reveal a marked increase in the number of active motor units in the muscle when voluntary contraction takes place against resistance as compared to assistive motion or even free motion against gravity.[13] Some muscles hardly respond at all until resistance is applied.[18] Without denying the importance of passive motion as a therapeutic measure to increase range of joint motion, it must be recognized that passive motion accomplishes nothing directly in improving function of paralyzed muscles, since no voluntary activity is induced in the motor units. In assistive motion, only a small percentage of all the motor units of the muscle is active in a single effort. Since the activity of the motor units is responsible for the therapeutic effect of the exercise, what conceivable advantage can there be in keeping the majority of the motor units in the muscle inactive in such a therapeutic program? It is evident that one is not sparing the muscle from excessive activity by using assistive motion, since all of the active motor units contract maximally (all-or-none). The inactive motor units are not responding at all and are therefore not receiving treatment. Furthermore, repetition of assistive motion would activate the same small group of motor units each time, since these are the units which have the lowest threshold of excitation. Even free motion with gravity eliminated and, in many instances, free motion against gravity excite a relatively small proportion of the motor units in the muscle. Only after application of maximal resistance do a large proportion of the motor units respond.

In our therapeutic program based on central facilitation, we have discarded many of the features of the accepted routine procedure in treatment of paralysis. Instead of progressing gradually through passive and assistive motion and free motion to resistance, we routinely apply maximal resistance from the beginning. Instead of attempting to avoid stretch of the paralyzed muscles in the neuromuscular reeducation program, we utilize stretch as an effective facilitation technique. Instead of meticulously reeducating isolated muscles we routinely apply therapy in mass movement patterns for greater facilitation. Instead of excessive concern to avoid fatigue we carry out an intensive program of maximal activity through a large part of each day and thereby develop greater endurance. We also utilize central facilitation or "active recuperation"[14] as a mechanism for decreasing central fatigue.

Our routine program of manual resistive exercise for treatment of paralysis is based on summation of a number of facilitation techniques in each exercise. In this way, the greatest possible facilitation is achieved with each voluntary effort of the patient. In addition to resistance, a mass movement pattern or combination of mass movement patterns and one of the techniques of reversal of antagonists are used routinely. Quite commonly, stretch and a

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[16] DeLorme, T. L., and Watkins, A. L.: Progressive Resistance Exercise — Technique and Medical Application, Appleton Century Crofts, Inc., New York, 1951.

[17] Gurewitsch, A. D.: Intensive Graduated Exercises in Early Infantile Paralysis, Arch. Phys. Med. 31:213 (April) 1950.

[18] Levine, M., and Kabat, H.. Proprioceptive Facilitation of Voluntary Motion in Man, J. Nerv. & Ment. Dis. (in press).

suitable reflex are added to improve the response in the exercise. It is important to note that these techniques require a great deal of special training, skill and experience, both for the doctor prescribing them and for the therapist who follows the prescription.

Facilitation Techniques

1. *Resistance.* — It is well established that resistance increases the response of muscles in voluntary contraction. This observation is common knowledge to weight lifters who use maximal resistance to build up muscle power and bring about hypertrophy. While resistive exercise through the use of weights is not new, DeLorme and Watkins have made a significant contribution in placing emphasis upon it as a treatment procedure.[16] The use of weights, pulleys, friction, anti-gravity exercises and similar techniques are valuable as methods of applying resistance and are used routinely in our treatment program.[7] Resistive exercise is also prescribed in occupational therapy.[10] On the other hand, we have found that manual resistance allows the greatest range of technical procedures for facilitation and is essential for effective treatment of paralysis.

The greatest flexibility in application of resistive exercise is afforded by individual treatment by a skilled physical therapist. The therapist can combine a variety of powerful facilitating techniques with resistance in order to obtain a greater response in voluntary contraction of weakened, paralyzed, and even "zero" muscles. Resistance can be varied through the range of motion exactly as needed to maintain a maximal contraction throughout the range. The therapist can also assist the patient to increase active range of motion by taking the joint beyond his active range and having him make a facilitated maximal isometric contraction. Manual resistance is also essential for guidance of the voluntary motion in the proper direction and elimination of substitution. In addition to application of resistance for fundamental neuromuscular reeducation, the therapist can also accelerate training of essential patterns such as sitting balance, standing balance, and balance on crutches by applying resistance in these more complex patterns. A close personal relationship is also developed between the patient and the therapist in the daily treatment periods and for this reason the therapist can elicit greater effort, concentration and cooperation.

While the effect of resistance in increasing the response of muscles in voluntary contraction is widely known and accepted without question, the physiologic mechanism involved has received little attention. In their recent book on progressive resistance exercise, DeLorme and Watkins[16] merely mention that resistance induces proprioceptive stimulation and present no thorough discussion of the fundamental physiologic mechanism of resistance.

Recently, experiments in monkeys by Gellhorn[19] have thrown considerable light on the mechanism of resistance. He was able to show that when a point on the motor cortex was stimulated to produce contraction in a particular muscle, the strength of the response was relatively slight when the joint was allowed to move freely as compared to the response obtained when the joint was fixed. Fixation of the joint in his experiments constituted resistance and he demonstrated that the mechanism of resistance was through proprioceptive stimulation by the increased tension in the muscle. Although a subthreshold electrical stimulus to the motor cortex point failed to bring about any discharge when the joint was allowed to move freely, the same stimulus elicited a contraction in the muscle when resistance and stretch were applied. He demonstrated in this way that the cortical stimulus which was too weak to excite an impulse by itself could summate with proprioceptive stimulation from the muscle to raise the level of excitation above threshold. To quote his paper:[19] "The effects seem to be based on the interaction of the proprioceptive impulses with those elicited by cortical stimulation, resulting in an increased number of discharging motor units."

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[19] Gellhorn, E. Proprioception and the Motor Cortex, Brain 72:35, 1949.

Further evidence that the proprioceptive impulses from the muscle are responsible for the facilitation of the response to cortical stimulation is the fact that the facilitation effect is eliminated by deafferentation of the limb.[20]

Another factor in the increased response of the muscle against resistance is related to the muscle itself rather than the nervous mechanism. Even in the isolated nerve-muscle preparation on supra-maximal nerve stimulation, increased length or increased load enhances the mechanical response of the muscle but not the electromyogram.[21] In voluntary motion or cortical stimulation, proprioceptive facilitation, resulting in a greater number of functioning motor units, is a much more important factor in the increased muscular contraction resulting from resistance and stretch than is the direct effect on the muscle itself.[21]

2. *Stretch.* — In many patients with paralysis, resistance applied to the shortened muscle may be relatively ineffective while resistance applied to the stretched muscle elicits a stronger response.[5-6-7-9] This is especially true in flaccid paralysis, as in poliomyelitis. Rapid stretch is particularly effective in producing facilitation in such techniques as sudden breaking of a hold followed immediately by active motion against resistance. Another method of quick stretch of the muscles is holding, relaxing, then active motion in rapid sequence.

Not only is stretching effective in facilitating contraction in the stretched muscle, but stretch of another muscle which is part of the same mass movement pattern can also produce facilitation of a paralyzed muscle.[7-9] For example: voluntary contraction of the iliopsoas muscle can be facilitated, not only by stretching of the iliopsoas but also by stretch of the anterior tibial muscle, which is associated with the iliopsoas in a total flexion pattern of the lower extremity.

Stretch of an antagonist, particularly if that muscle is spastic, may inhibit both range of motion and facilitation of voluntary contraction of the agonist muscle. Use of a position in which stretch of the antagonist is avoided will allow greater facilitation of the agonist.. As an example: contraction of the anterior tibial muscle may be minimal while the patient is supine with the knee extended; yet the same muscle will contract with considerable strength against resistance with the hip and knee flexed.[5-6] In the more favorable position, stretch of the spastic gastrocnemius is effectively reduced.

On the other hand, stretch of the antagonist may in some instances apparently stimulate a better response of the agonist. We have noted particularly in athetosis that the voluntary contraction in the shortened range of the muscle against resistance is usually greater than in the lengthened range.[5-6]

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[20] Hyde, J., and Gellhorn, E.: Influence of Deafferentation on Stimulation of Motor Cortex, Am. J. Physiol 156:311, 1949.

[21] Loofbourrow, G. N.: Electrographic Evaluation of Mechanical Response in Mammalian Skeletal Muscle in Different Conditions, J. Neurophysiol. 11:153, 1948.

Gellhorn[19] demonstrated in the monkey that stretch of a muscle added to resistance further facilitates the response of this muscle to electrical stimulation of the proper cortical focus. Resistance is a more powerful facilitation mechanism than stretch. The combination of stretch and resistance greatly increases the recruitment of anterior horn cells in response to weak stimulation of the motor cortex: "The magnitude of the intensification is considerable since subthreshold cortical stimulation may be made effective by bringing proprioceptive impulses into play, whereas often even a considerable increase in stimulus intensity fails to cause the same motor effect in the absence of such facilitatory proprioceptive impulses." [19] Gellhorn also showed that stretch of a synergistic muscle in the mass movement pattern also has a facilitating effect on the response of the prime mover to cortical stimulation.

3. *Mass Movement Patterns.* — In the usual routine of treatment of paralysis, great emphasis has been placed on contraction of isolated muscles or performance of single elementary motions such as flexion of the elbow or extension of the wrist.[1] This is believed to be the best method of developing voluntary control through neuromuscular reeducation. By concentrating the patient's attention and effort on a single muscle or elementary motion it is felt that more effective recovery from paralysis results.

For a number of years, we have been convinced that the procedure of treatment of isolated muscles or isolated motions is relatively ineffective and unsound. A single muscle or an isolated individual motion is practically never used in the performance of voluntary activities. Furthermore, powerful facilitation of the voluntary response of a paralyzed muscle can be brought about through performance of a mass movement pattern of an entire extremity against resistance.[5-6-7-8-9] In a particular patient, the anterior tibial muscle which fails to respond at all in free motion or against resistance in an isolated motion, definitely contracts when the patient performs a mass flexion pattern of the entire lower extremity against maximal resistance. This facilitation occurs only if the hip and knee flexors respond with sufficient power to overflow innervation to the paralyzed anterior tibial. However, if the hip and knee flexors were also severely paralyzed, facilitation of the anterior tibial muscle from this procedure would not ensue. The mechanism of overflow of excitation to a paralyzed muscle in a mass movement pattern is apparently similar to irradiation in reflexes.[3]

The facilitation in a mass movement pattern can occur not only through overflow from functioning proximal muscles to paralyzed distal muscles in the extremity but also in the reverse direction. A relatively strong anterior tibial muscle can facilitate a paralyzed iliopsoas muscle when the mass flexion pattern is performed against maximal resistance. As mentioned previously, stretch of synergistic muscles in a mass movement pattern is also an effective facilitation mechanism. Because of the great value of the facilitation produced by mass movement patterns, we have to a large extent discarded exercise of individual motions and routinely use mass movement patterns in the therapy of paralysis.[5-6-7-8-9]

Primitive complex patterns of motion are used routinely in normal activities requiring great effort in work and sports. Examples include: chopping wood, running, using a shovel, throwing a ball, swimming, and pulling up weeds. Careful analysis of these motions reveals that the direction of the motion is not straight, but is diagonal and spiral. This probably corresponds to the anatomical distribution of the muscles in the pattern for the application of the greatest power. We have found that diagonal, spiral mass movement patterns are usually more effective in facilitation than are straight mass movement patterns.[7-9] For example, greater facilitation of a paralyzed peroneal muscle can be achieved by overflow from a diagonal spiral pattern of extension, abduction, internal rotation of the hip against resistance, than from a pattern of straight abduction of the hip. An example of a diagonal mass movement pattern of the upper trunk is: flexion, lateral motion and rotation of the neck and upper trunk to the right, with extension, adduction, internal rotation of the left shoulder. This is a motion of rolling over to the right from the supine position, in an adversive movement. A diagonal spiral pattern of the lower extremity is: flexion, adduction, external rotation of the hip; flexion of the knee; dorsiflexion, inversion of the ankle and extension of the toes. An example of the upper extremity is: flexion, abduction, external rotation of the shoulder; extension of the elbow, supination; radial extension of the wrist and opening of the hand.

Frequently, a combination of mass movement patterns produces greater facilitation.[5-6-7] If the left hip flexors are much stronger than the right, the affected right hip flexors will show a stronger response from bilateral symmetrical mass flexion patterns of the lower extremities than from flexion of the right leg alone. In this way, bilateral symmetrical, asymmetrical and reciprocal mass movement patterns of upper or lower extremities may be effective in facilitation. The response of a paralyzed muscle in the lower extremity may also be augmented by a combination of mass movement patterns of the leg with the stronger opposite arm in a primitive running pattern.

Instead of treating severely paralyzed and "zero" muscles in the usual way with assistive isolated motion yielding little or no response, such muscles are treated in our program routinely against resistance with a variety of facilitation techniques including overflow from less involved muscles in a mass movement pattern or combination of patterns. Whereas the usual physical therapy program is devoted almost exclusively to the more involved muscles, our facilitation program devotes much attention to the less involved muscle groups as well. But in this process, rather than neglecting the more severely paralyzed muscle groups, these muscles recover function much more rapidly because their response is facilitated. Also, coordinated patterns which can carry over directly into practical activities are developed more effectively. Another significant advantage of mass movement patterns is that a large number of muscles is exercised at one time so that the therapist can accomplish much more in each treatment period than when isolated individual motions are performed.

Mass movement patterns are prescribed not only in manual resistive exercise in daily individual physical therapy periods, but are also applied in the gymnasium. Mass movement patterns and combinations are carried out against the resistance of pulleys, dumbbells or weighted boots. Primitive natural patterns are also applied in mat work in activities such as crawling, rolling over, sitting up and anti-gravity exercises.[22] Resistive exercise in mass movement patterns has also proved useful in many cases in occupational therapy.

From extensive observations on a large number of patients with neuromuscular disorders, it is apparent that even in those with severe paralysis from various lesions, such as of the corticospinal tracts, anterior horn cells, or cerebellum, the mass movement patterns are still relatively undisturbed.

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[22] Haller, J. S., and Gurewitsch, A. D.: An Approach to Dynamic Posture Based on Primitive Motion Patterns. Arch. Phys. Med. 31:632, 1950.

The patterns are also demonstrable in patients with Parkinson's disease. Of all types of paralysis studied, the only patients who showed disruption and disturbance of the mass movement patterns were those with athetosis.[7] Since patients with athetosis have disturbed patterns but patients with Parkinson's disease do not, only part of the basal ganglia, presumably the neostriatum, appears to be directly related to the mechanism of mass movement patterns.

Inman, Saunders, and Abbott[23] were impressed by the importance of patterns of motion for muscle reeducation, they state: "There is, for example, no such thing as a prime mover, as ordinarily understood. There are only patterns of action. This conception extends and amplifies the axiom laid down by Beevor when he said with regard to the brain that it knows nothing of the action of the individual muscles, but only of movement. . . . Sampling of various portions of an individual muscle shows that they can act independently, but synchronously in association with the total pattern of a specific movement. This great principle is absolutely fundamental for establishing rational procedures of muscle re-education. These patterns of muscular activity cannot be reduplicated by voluntary contraction of the muscle alone. They can only be brought into play by carrying out the precise motion itself, which probably brings into play proprioceptive mechanisms. . . . Motion, and motion alone, is the only known stimulus able to engender, in phase and degree, the muscle activity requisite for the establishment of the pattern as a whole."

Gellhorn presents conclusive evidence that mass movement patterns are excited by electrical stimulation of a single point on the motor cortex. In a recent paper,[24] he stated: "Stimulation of the motor cortex in anesthetized monkeys (Macacus rhesus) under threshold conditions . . . . shows that not single muscles or parts of muscles are activated, but muscle groups which are functionally interrelated. Such grouped muscle activity which seems to be the basis of coordinated movement is induced in a similar manner from all parts of the motor cortex on threshold stimulation. No essential differences were found between areas 4 and 6 in this respect." In others words, the response to very weak electrical stimulation of an individual focus in the motor cortex is in a synergistic pattern of muscles at more than one joint, rather than a single muscle or single motion. In another paper,[19] Gellhorn demonstrated that proprioceptive impulses induced by resistance and stretch become effective in facilitating the response to cortical stimulation not only in the stretched and resisted muscle but throughout the mass movement pattern, he states: "In addition, proprioceptive impulses thus induced become effective, although to a lesser extent, in those muscles with which the proprioceptively excited muscle forms specific functional associations. . . . For instance, proprioception originating in the biceps increases also the reactivity of the extensor carpi to cortical stimulation; similar relations exist between triceps and hamstrings; hamstrings and anterior tibial muscle. It was shown also that this effect occurs in the opposite direction within these complexes. For example, fixation of the wrist in ventroflexion increases the reactivity to cortical stimulation not only of the extensor carpi but also of the biceps muscle."

In a more recent paper, Gellhorn and Johnson[25] observed that stimulation of an individual focus of the motor cortex in the monkey excites a highly specific mass movement pattern of the entire limb. In these experiments, the patterns of the fore-limb were investigated more thoroughly, they write: "The biceps complex was found to consist largely of the flexors of the elbow, the extensors of wrist and fingers and acromio-deltoid muscle, while the triceps complex comprised, in addition to the extensors of the elbow, the flexors of the wrist and fingers and most of the shoulder muscles with the exception of the acromiodeltoid muscle." These patterns were facilitated by proprioceptive stimulation through stretch and resistance.

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[23] Inman, V. T.; Saunders, J. B., and Abbott, L. C.. Observations on the Function of the Shoulder Joint, J. Bone & Joint Surg. 26:1, 1944.

[24] Gellhorn, E.: Validity of the Concept of Multiplicity of Representation in the Motor Cortex Under Conditions of Threshold Stimulation, Brain 73:267, 1950.

[25] Gellhorn, E., and Johnson, D. A.: Further Studies on the Role of Proprioception in Cortically Induced Movements of the Foreleg in the Monkey, Brain 73:513, 1950.

Our observations on facilitation of voluntary motion in patients with paralysis were made independently of Gellhorn's experiments on facilitation of the response to electrical stimulation of the motor cortex in monkeys. It is apparent, however, that the demonstrated facilitation mechanisms are essentially similar in the monkey and in man. The striking facilitation effect induced by stretch and resistance in patients is identical in the monkey experiments.[19] The specific synergistic patterns of an entire limb as demonstrated in the fore-limb of the monkey through electrical stimulation of the motor cortex[25] are similar to the mass movement patterns which we have found useful as a powerful facilitation mechanism for the upper extremity in patients. Both Gellhorn's experiments and our observations confirm the fact that the mass movement patterns are equally effective in a distal-to-proximal as in a proximal-to-distal direction.

4. *Reflexes.* — A number of reflexes can be utilized as facilitation techniques. The procedure is to stimulate the reflex and perform voluntary motion against resistance in the same muscle group simultaneously, using the reflex excitation to facilitate the voluntary neuromuscular response.[5-6-7-9] The reflex stimulus must be weak enough so that the voluntary component of the response is as great as possible. The reflex may be stimulated continuously while the voluntary component is alternately contracted and relaxed. Also, the period of after-discharge of the reflex may be utilized in combination with voluntary motion against resistance.

Besides the simple stretch reflexes discussed above, other proprioceptive reflexes are of value as facilitation techniques in treatment of paralysis. These include the postural and righting reflexes such as the tonic neck reflexes of Magnus and vestibular reflexes.[5-6-7-9] Another example is the positive supporting reaction which is the extensor thrust elicited by pressure stimulation on the plantar surface of the foot.[6] In carrying out therapy for sitting balance, kneeling balance, and standing balance against resistance, large complex patterns of muscular response are excited with facilitation from postural and righting reflexes. Other reflexes which can facilitate voluntary effort to increase contraction in paralyzed muscles include the mass flexion reflex of the lower extremity (von Bechterew reflex), and gag reflex.[5-6-7-9]

Loofbourrow and Gellhorn[26] demonstrated that activity in the same functional associations of muscle groups in patterns is induced by stimulation of stretch reflexes of the muscles as is produced by electrical stimulation of the motor cortex. From this they reason that the same mechanism may play a role in voluntary motion and in simple proprioceptive reflexes. In another paper,[27] the same authors showed that reflexes produced by electrical stimulation of afferent nerves brought about responses in the identical patterns of specific synergistic muscle groups. The motor responses in the patterns in

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26. Loofbourrow, G. N., and Gellhorn, E.. Proprioceptively Induced Reflex Patterns, Am. J. Physiol. 151:433, 1948.

27. Loofbourrow, G. N., and Gellhorn, E.: Proprioceptive Modification of Reflex Patterns, J. Neurophysiol. 12:435, 1949.

these reflexes were facilitated by stretch and resistance in a manner similar to the proprioceptive facilitation observed in experiments on cortical stimulation.

5. *Reversal of Antagonists.* — In the performance of many activities in work and sports, the antagonist motion is carried out immediately preceding the main action. For example: in pitching a baseball, the arm is first brought back, the trunk rotated and the opposite leg raised and then, in a continuous sequence without interruption, the ball is thrown. The antagonist motion precedes the action in chopping wood, the golf swing, kicking a football, using a scythe and many other activities. The contraction of the antagonist against resistance immediately preceding resistive exercise of the agonist is a valuable technique of facilitation.[6-7-9] The stronger the contraction of the antagonist, the greater is the facilitation of the agonist muscle. This technique is particularly effective when the agonist is paralyzed and the antagonist is relatively uninvolved. Reversal of antagonists is usually applied in mass movement patterns against maximal resistance and can be summated with other facilitation techniques. Frequently, repeated reversal of antagonists builds up greater facilitation, and is followed by repeated resistive exercise of the agonist pattern. When fatigue of the agonist pattern sets in, another reversal of antagonists helps to overcome the fatigue and restore effective facilitation.

The facilitating effect of rapid alternating contraction of antagonistic muscle groups against maximal resistance can be applied in a number of specific techniques:

(a) *Rhythmic Stabilization.*[6-7-9] — This is a technique of rapid alteration of isometric contraction of antagonists against maximal resistance. The patient attempts to hold a rigid position of a joint and the therapist alternates maximal resistance in one plane in an attempt to move the joint. As an example: the patient holds the wrist rigid in the neutral position and the therapist rhythmically applies resistance alternately to the radial extensor, then the ulnar flexor, then radial extensor, etc. After the patient alternates isometric contraction of the antagonist muscles, the power of contraction of the muscles increases, following which maximal isotonic contraction of the agonist is performed repeatedly against resistance. Rhythmic stabilization is carried out in mass movement patterns and summated with other facilitation techniques for greater response.

Rhythmic stabilization is effective as a facilitation technique in patients with lower motor neuron lesions, lesions of the corticospinal tracts and basal ganglia. On the other hand, patients with cerebellar involvement fail to show facilitation from this technique and even fail to perform rhythmic stabilization successfully.[6-7-9]

(b) *Isometric Reversal of Antagonists.*[7] — In this method, alternating active motion of the antagonists is carried out against maximal resistance. This procedure can be performed using the entire range of joint motion or using a part of the range. This technique is applicable in all types of paralysis.

(c) *Isotonic Reversal of Antagonists with Isometric Contraction.* — In this facilitation method, the patient performs isotonic contraction of the antagonist through the range, then isometric contraction of the antagonist in the shortened range, followed immediately by active motion of the agonist through the range succeeded by holding with the agonist. The procedure is carried out against maximal resistance and usually repeated alternation of antagonistic muscle contractions is performed.

(d) *Quick Reversal of Antagonists.*[*] [6-7] — In this technique of facilitation of voluntary motion, active motion of the antagonist is carried out through the range rather slowly against maximal resistance, then suddenly the motion is reversed and the agonist is contracted and assisted as rapidly as possible to the shortened position, immediately following which there is an isometric contraction of the agonist against maximal resistance.

One of the fundamental principles of functioning of the reflex centers in the spinal cord is successive induction.[3] If the flexion reflex is carried out in a spinal animal, immediately afterward the excitability of the antagonist response, the extension reflex in that limb, is considerably increased. In other words, the previous activity in the antagonist centers is followed immediately by a period of facilitation of the agonist pattern. The principle of successive induction is also applicable to voluntary motion.

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[*] This technique was first suggested by one of our therapists, Miss Luba Brisker.

While the response to weak cortical stimulation is contraction of the agonist with inhibition of the antagonist muscle group (reciprocal innervation), co-contraction results from increased intensity of cortical stimulation as well as from strong proprioceptive facilitation of a weak cortical stimulus.[19] In co-contraction, both antagonists contract simultaneously with stronger contraction of the agonist group. In therapeutic exercise with maximal facilitation of the motor response, co-contraction would occur and with this background of simultaneous excitation in both antagonists, alternation of antagonists should increase facilitation. When the agonist is resisted, the antagonist would be in a state of partial contraction and heightened excitability. When the resistance is reversed and suddenly applied to the antagonist, a stronger proprioceptive stimulus would be induced because the antagonist muscle is already partially contracted rather than flaccid. Furthermore, the facilitation of the antagonist is favored by the previous excitation of this muscle in co-contraction. This facilitation should build up higher with each reversal of the antagonists, for a time. Such a progressive increase in facilitation with repeated reversal of antagonists does in fact occur.[6-7-9] In addition, in isotonic reversal of antagonists carried through the range of motion, not only would the proprioceptive stimulation from resistance be greater, but the muscle would also be on maximal stretch at the moment of reversal of the antagonists.

Summary

1. For greatest effect in restoring power in paralyzed muscles, the goal should be maximal activation of the motor units of the affected muscles with each effort. A maximal voluntary muscular contraction is dependent on the highest possible level of excitation at synapses on the anterior horn cells, and can only be achieved through strong facilitation and summation of excitation in the central motor mechanisms.

2. From clinical experience and physiologic investigations on patients, we have applied a number of practical facilitation techniques which are valuable in the treatment of paralysis. These include:

(a) Resistance.
(b) Stretch.
(c) Mass movement patterns.
(d) Reflexes.
(e) Reversal of antagonists.

These techniques are combined for summation of facilitation. This new treatment program routinely applies mass movement patterns against resistance, and the old procedure of treatment of isolated muscles or isolated motions has largely been discarded. The usual routine of progressing gradually from passive motion, through assistive motion and free motion to resistance has also been eliminated.

3. A careful analysis of the physiologic mechanisms of these therapeutic facilitation techniques indicates that these methods have a sound fundamental basis. The recent experiments of Gellhorn on the influence of proprioception

on the functioning of the motor cortex and the older work of Sherrington, throw considerable light on these facilitation mechanisms. Gellhorn has clearly demonstrated the same facilitation effects from application of resistance, stretch and mass movement patterns on the response to electrical stimulation of the motor cortex in the monkey as we have found in voluntary motion in patients. Gellhorn's experimental evidence that a mass movement pattern results from threshold electrical stimulation of an individual focus of the motor cortex in the monkey illustrates the fundamental nature of these patterns. Sherrington demonstrated that deafferentation renders a limb entirely and permanently incapable of voluntary motion, even though the response to electrical stimulation of the motor cortex is unimpaired.

The underlying physiologic mechanism of resistance, stretch and mass movement patterns is essentially proprioceptive. Postural and righting reflexes and related facilitation techniques are also proprioceptive in nature. The facilitating effect of reversal of antagonists is due to successive induction, proprioceptive stimulation, and co-contraction.

These powerful proprioceptive facilitation mechanisms have been harnessed for the more effective treatment of paralysis.

Discussion

Dr. Harriet Gillette (Atlanta, Ga.): A significant contribution to the armamentarium of physical therapy procedures has been made by Dr. Kabat. The concept of patterns of movement as opposed to isolated contractions is being considered more now than ever before, and is supported by increasing knowledge of cortical and subcortical mechanisms.

The term "paralysis" is a broad one, which includes clinical pictures of abnormal muscle movement brought about by destruction of any one of several different nervous mechanisms. Pyramidal tract lesions differ from extrapyramidal both to the eye and electromyographically. Spinal cord lesions may destroy anterior horn cells, as well as central facilitory or inhibitory centers. The effector organ, the muscle, knows only contraction; but this function is governed by a multitude of controls.

Patients vary widely in age, temperament, mentality, general health and stamina; and each requires an individualized treatment program, taking into account all the factors which go to make up a whole person.

A consideration of body mechanics, with prevention or correction of deformity and with even distribution of muscle strength throughout trunk and extremities, is of utmost importance in poliomyelitis; and it can be best achieved through isolated muscle reeducation. Power is not always the desired end result; on occasion it may be desirable to sacrifice power for ease and grace of motion. Passive and active assistive motion still are indispensable adjuncts in the treatment of many forms of disability.

The techniques of central facilitation as outlined by Dr. Kabat are successful and useful ones. I personally have experienced gratifying results with the use of some of them. However, I am constantly reminded that the art of medicine lies in a knowledge of the application and the judicious use of its many tools.

* * *

THE SO-CALLED BICIPITAL SYNDROME OF THE SHOULDER *

ROBERT W. NEWMAN, M.D.

IOWA CITY, IOWA

The purpose of this paper is to call attention to a clinical entity, bicipital tendinitis, bicipital tenosynovitis, or bicipital syndrome of the shoulder joint, with which my observations lead me to believe the members of the Medical Profession in general are unfamiliar, but which constitutes a major factor in the production of an ailment with which all of us are only too familiar, that of the painful, stiff shoulder. A substantial part of the practice of most orthopedic surgeons is made up of the care and treatment of this condition. It is undoubtedly the most common ailment of the shoulder and is of great importance not only because of its frequency of occurrence but also because of the prolonged disability it generally entails. Although in relatively recent years much enlightening information on this subject has been provided by various workers, we have not yet arrived at a complete understanding of the etiology and pathogenesis of this symptom complex.

In speaking of the painful, stiff, or "frozen" shoulder, reference is made to that clinical syndrome of pain of varying intensity occurring in the shoulder with or without antecedent trauma, associated with limitation of motion of varying degrees, but characteristically progressing to almost complete restriction, the so-called frozen shoulder. It is infrequently seen in individuals under 40 years of age, and its course is characteristically exceedingly protracted, extending over periods of months to years, and generally terminating in spontaneous recovery. It should be pointed out that, contrary to the general conception, all cases do not eventuate in complete spontaneous cures in four months to three years. There are many who never spontaneously regain normal function.

Until Duplay[1] in 1896 presented his belief that the extra-articular tissues of the scapulo-humeral joint as distinct from the intra-articular structures, were the primary source of pain and limitation of motion, this condition was considered as arthritis of the shoulder joint. Duplay's description corresponds to what we now think of as "frozen shoulder." He regarded the subacromial bursa as a separate joint, and assigned inflammation of this bursa as the cause of the condition, designating it "scaplo-humeral periarthritis."

About the time of the appearance of Duplay's paper, x-ray came into use, and then for the first time calcific deposits were observed in the periarticular tissues of the shoulder joint. Painter[2] in 1907 and Baer[3] in the same year published the first papers in this country on the subject. They believed that these deposits might be the cause of pain and restricted motion in the shoulder and recommended their surgical removal as the indicated treatment. But, since these deposits were observed in shoulders without pain, as well as in those with pain, the general term periarthritis continued to apply to the painful, stiff shoulder, with or without calcium deposits. Though King and Holmes[4] in 1927 urged that interpretation of the symptoms be based on the

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* Read at the Twenty-ninth Annual Session of the American Congress of Physical Medicine, Denver, Colorado, September 7, 1951.

[1] Duplay, S.: De la Periarthrite Scapulo-humérale, Rev. prat. d. trav. de méd. 53:226, 1896; Rev. prat. on Scapulo-Humeral Periarthritis (Paris Clinical Lectures), Med. Press 69:571, 1900.

[2] Painter, C. F.: Subdeltoid Bursitis, Boston M. & S. J. 156:345, 1907.

[3] Baer, W. S.: Operative Treatment of Subdeltoid Bursitis, Bull. Johns Hopkins Hosp. 18:282, 1907.

[4] King, J. M., Jr., and Holmes, G. W.: Diagnosis and Treatment of 450 Painful Shoulders, J. A. M. A. 89:1956, 1927.

pathologic process, Mumford and Martin[5] in 1931 and Dickson and Crosby[6] as late as 1932, expressed the view that there was no clinical difference between the painful stiff shoulders with calcium deposits and those without.

It was at this period that Doctor E. A. Codman's[7] exhaustive book on the shoulder appeared. This work provided abundant information relative to the pathogenesis of the painful stiff shoulder. It served to separate from the general group of cases of pain and limited motion of the shoulder, designated "periarthritis," three distinct clinical entities: calcareous tendinitis, rupture of the supraspinatus tendon, and the frozen shoulder. While the etiology and pathology of the former two, calcareous tendinitis and rupture of the supraspinatus tendon, were presented with such clarity and comprehensiveness that little has been added since, the "frozen shoulder" presented an unsolved problem to him. He expressed himself as of the opinion that the biceps tendon and its sheath had little to do with the production of pain and restricted motion.

It has, however, become increasingly apparent that this structure, the biceps tendon, is of considerable importance in this clinical syndrome, and it is now being assigned a major role. During the second decade of this century, A. W. Meyers[8] in a series of papers presented a wealth of information relative to various changes in the biceps tendon, its sulcus and related soft tissue structures. His investigations involved the dissection of approximately 2,000 shoulder joints and yielded convincing evidence that the intertubercular sulcus, the biceps tendon and associated structures must play an important role in the production of the painful shoulder with restricted motion. He observed evidence of degenerative and attritional changes as manifested by fraying, thinning and irregular splitting of the biceps tendon. In a number of shoulders he found complete absence of the intra-articular portion of the tendon and further that the extra-articular tendon had securely attached itself in the region of the sulcus and the lessor tuberosity. In several specimens he found dislocation of the tendon from its sulcus.

Up to this time, these findings apparently had no clinical counterpart. Dr. Meyers stated, "Such cases apparently do not appear in clinics and dispensaries, for pathologists and orthopedic surgeons seem to be unfamiliar with them." In 1934, Codman[7] wrote in reference to the production of shoulder symptoms, "Personally, I believe that the sheath of the biceps tendon is less apt to be involved than are the other structures. I have never proved its involvement in a single case." Shortly before this, however (1926), Gilcreest,[9] in discussing rupture of the tendon of the long head of the biceps based on clinical analysis of 100 cases, suggested implication of the biceps tendon in the painful shoulder. He considered "acute" and "latent" ruptures and felt that the latter were overlooked and diagnosed as arthritis or bursitis.

It was not, however, until about 18 years ago that the bicipital syndrome, or bicipital tendinitis was enunciated as a clear-cut and separate clinical syndrome. The enlightening and original work of Pasteur[10] served to provide the clinical counterpart to the exhaustive anatomic investigations and observations of Dr. Meyers, made in the dissection room. He used the term "teno-bursite bicipitale" in referring to this syndrome and suggested that tenosynovitis of the long head of the biceps was the esesntial pathologic factor underlying the painful, stiff shoulder, and he definitely related it to the "frozen shoulder." Shortly after the appearance of Pasteur's work Shrager's[11] excellent paper appeared, supporting and amplifying Pasteur's observations. He clearly presented and established, perhaps for the first time in American literature, tendinitis of the long head of the biceps as a clinical entity.

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[5] Mumford, E. B., and Martin, F. J.: Calcified Deposits in Subdeltoid Bursitis, J. A. M. A. 97:690, 1931.

[6] Dickson, J. A., and Crosby, E. H.: Periarthritis of the Shoulder: Analysis of Two Hundred Cases, J. A. M. A. 99:2252, 1932.

[7] Codman, E. A.: The Shoulder. The Author, 1932.

[8] Meyers, A. W.: (a) Unrecognized Occupational Destruction of the Tendon of the Long Head of the Biceps Brachii, Arch. Surg. 2:130, 1921; (b) Spontaneous Dislocation of the Long Head of the Biceps Brachii. ibid. 13:109; (c) Spontaneous Dislocation and Destruction of the Tendon of the Long Head of Biceps Brachii. ibid. 17:493, 1928.

[9] Gilcreest, E. L.: (a) Subcutaneous Rupture of the Long Head of Biceps Flexor Cubiti, S. Clin. North America 6:547, 1926; (b) Dislocation and Elongation of Long Head of Biceps Brachii, Ann. Surg. 104:118, 1936.

[10] Pasteur, F.: La teno-bursite beicipitale, J. de radiol. et d'électrol. 16:419, 1932.

Having finally established the bicipital syndrome as a definite clinical entity, what is the present status of our knowledge concerning this symptom complex? Have we arrived at a complete understanding of the etiology and pathogenesis of this ailment? Has its relationship to the painful, stiff and "frozen shoulder" been clearly and definitely established? It is my belief that several workers interested in this problem in recent years have gone far to provide us with an affirmative answer to these queries.

Lippmann[12] explored 32 shoulder joints involved in the so-called periarthritis or pain and restricted motion, and found tenosynovitis of the long head of the biceps to be present in all. In only one instance was rupture of the musculo-tendinous cuff observed and in two cases adhesions in the subacromial bursa were noted. He considered that interpretation of his findings left only two alternatives, either involvement of the tendon of the long head of the biceps is incidental to a pathologic process or the changes in this structure represent a "basic element of the disease." The former he rejects as untenable and accepts the alternative, "that tenosynovitis of the long biceps tendon constitutes the underlying pathologic basis of at least most cases of so-called periarthritis," and he recommends that the term bicipital tenosynovitis be employed rather than periarthritis.

Lippmann is of the opinion that his operative findings suggest an explanation of the sequence of events incident to the development of the symptom complex of the typical painful, stiff shoulder and of its eventual spontaneous recovery. He maintains that when the clinical symptoms are correlated with the pathologic findings at operation, it is apparent that the early pain and associated restricted motion are incident to the active inflammatory involvement of the biceps tendon mechanism. As the process subsides and the biceps tendon becomes firmly anchored in the intertubercular groove by dense adhesions, pain vanishes and motion gradually returns. The author suggests an explanation of the exact manner in which bicipital tenosynovitis of the long biceps tendon produces the so-called frozen shoulder. He points out that inflammatory process involves the biceps tendon both in its intra-articular and extra-articular portions; that dense adhesions are formed, which bind the tendon not only to the bicipital sulcus outside of the joint, but to the capsule above the tendon and to the articular surface of the head of the humerus below the tendon, within the joint. Adhesive subacromial bursitis, contractures incident to prolonged immobilization, and mechanical block resulting from intra-articular infolding of the biceps tendon, he dismisses as untenable and not in accord with his observations at operation.

Hitchcock and Bechtol[13] likewise feel that lesions of the tendon of the long head of the biceps are among the most frequent causes of pain and restricted motion of the shoulder joint. Twenty-six cases of the clinical syndrome of bicipital tenosynovitis, that is, pain and restricted motion in the shoulder, tenderness localized to the bicipital sulcus, and pain caused by digitally displacing the biceps from side to side, they submitted to surgery. All cases revealed pathologic involvement of the biceps tendon-tendon-sheath structures. Excision of the intracapsular portion of the tendon and fixation of the extracapsular portion in the bicipital sulcus yielded most satisfactory results in every case. The authors maintain that the frequency of involvement of the biceps tendon and the pathologic changes observed involving this structure, result from predisposing factors in combination with phylogenetic and functional influences. Of major importance as predetermining factors they consider the so-called supra-tubercular ridge, first mentioned by Meyers,[8] 1928, and an abnormally shallow intertubercular sulcus. From the phylogenetic point of view they have found that in respect to the conformation of the bicipital groove man is unique among the primates. They observed in a study of shoulder specimens of the gorilla (22), chimpanzee (38), gibbon (28), and orangutan (18), that the angle of the medial wall was identical in all. Review of 100 human humeri revealed, on the other hand, marked variations in the depth of the groove, as expressed by the angle of the medial wall. The supra-tubercular ridge, which is in reality a continuation onto the head of the humerus of the medial wall of the bicipital sulcus, they found to be present as a complete structure in 8 per cent of the specimens and as a partial ridge in 59 per cent. They feel that the presence of a small spur off the tip of the lesser tuberosity in 45 per cent of the humeri with a supra-tubercular ridge, and in only 3 per cent of those without such a ridge indicates previous inflammatory activity as the result of abnormal pressure against the fibrous roof of the biceps tendon.

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[11] Schrager, V. L.: Tenosynovitis of the Long Head of the Biceps Humeri, Surg. Gyn. & Obst. 66:785, 1938.

[12] Lippmann, R. K.: Frozen Shoulder; Periarthritis; Bicipital Tenosynovitis, Arch. Surg. 47:283, 1943. N. Y. State J. of Med. 44:2235, 1944.

[13] Hitchcock, H. H., and Bechtol, C. O.: Painful Shoulder, J. Bone and Joint Surg. 30-A:263, 1948.

The James Edwards Professor of Orthopedic Surgery at the Jefferson Medical College, Doctor A. F. DePalma,[14] has written a large volume on the shoulder which was recently (1950) published. It is fundamentally sound and constitutes by far the most comprehensive work on the shoulder yet to appear. It is unique in that the author presents observations based on a combination of a very large clinical experience and a most extensive anatomic and pathologic investigation. He has gone further, however, and by inquiry and examination painstakingly gathered clinical information with reference to the shoulder on a large number of patients hospitalized for various ailments. Upon the death of many of these patients he was later able to study their shoulder joints at the autopsy tables. The section dealing with the painful, stiff shoulder comprehends the largest number of cases so far recorded. It is based on the clinical investigation of 83 cases, 56 of which he operated on. He has attempted to correlate these operative findings with those observed in his extensive investigation of degenerative lesions of the shoulder, embracing a study of 452 shoulder joints. Three hundred and eight of them were cadaver specimens. He explored at autopsy 144 shoulders, a history and examination of the shoulder having been obtained prior to death on all of this group. Only those shoulders were studied at autopsy which previous clinical inquiry and examination indicated were free of pathologic involvement. As a result of these extensive investigations and his findings at surgery; viz., that all 56 shoulders on which he operated revealed varying degrees of involvement of the tendon-tendon-sheath gliding mechanism of the long head of the biceps, he concludes that bicipital tenosynovitis is the most common cause of the so-called "frozen shoulder."

The author explains the characteristic restricted motion of this group of cases on the basis of voluntary immobilization incident to the painful motion resulting from bicipital tenosynovitis in shoulder joints already exhibiting "profound degenerative alterations in the synovialis, the musculo-tendinous cuff and biceps tendon." This he holds to be the reason that frozen shoulder rarely occurs in individuals under 40 years of age. He points out that bicipital tenosynovitis, playing as it does a major role in the symptomatology and course of the painful stiff shoulder, is the "prime causative factor responsible for pain both in the early and late phases of the disease." This he concludes on the basis of the clinical findings of pain and tenderness over the bicipital groove and the biceps tendon and the "dramatic and instantaneous relief of pain" in this series of cases after the removal of the intracapsular portion of the degenerated and adherent tendon and the relocation and fixation of the extracapsular portion.*

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[14] DePalma, A. F.: Surgery of the Shoulder, J. B. Lippincott Co., Philadelphia, 1950.

Summary and Conclusion

Periarthritis, or the painful stiff shoulder, is a very disabling ailment which is characteristically of prolonged duration, six months to three or four years. An attempt has been made to indicate the fact that pathologic changes in the biceps tendon probably play a major role in the production of this symptom complex.

Discussion

Dr. John H. Kuitert (Wash., D. C.): Dr. Newman is to be complimented on so ably and clearly accomplishing the stated purpose of his paper, which is to reemphasize the bicipital syndrome as a clinical problem. He has carefully traced the historical events in the development of this concept and as a result of his own observations he assigns a major role to the biceps mechanism in the production of the clinical "frozen" shoulder.

Cinematography has shown that some of our previous concepts concerning relative motions of the shoulder joint proper should be revised. It now appears that the first 90 degrees of flexion and abduction occurs in the shoulder joint proper, after which elevation is carried out by rotation of the scapula on the chest wall in which movements of the sterno-clavicular and acromio-clavicular joints take part. Complete elevation in abduction is associated with external and/or internal rotation of the humeral head to avoid impingement of the head on the acromial process. Thus, if rotation is limited by adhesions, glenohumeral range may be restricted.

Lippmann has pointed out:

> "(1) No motion of the biceps tendon in its groove can be produced by contraction of the biceps if the shoulder is held immobile.
>
> (2) Any motion of the shoulder joint entails motion of the bicep tendon in its grooves."

Clinical lesions of the biceps tendon may have been overshadowed by the writings of Codman, who focussed attention on the supraspinatus tendon; Dr. Newman's observations are in agreement with Moseley who has said "when the bicipital syndrome is correctly diagnosed it will be found equal in importance and numbers to the lesions of the rotator cuff in causing shoulder pain."

The term "frozen shoulder" is common but somewhat unsatisfactory and perhaps should be reserved for the clinico-pathological syndrome in which little to no active or passive motion is possible in the shoulder joint without actual intraarticular ankylosis being present. Used in this sense it is difficult to limit the cause of the condition to bicipital tendinitis alone.

Dr. Martin in his essay on fibrositis pointed up a gradually painful, slowly stiffening shoulder which he has treated as an inflammatory condition.

Exercise and unusual use of the biceps and its tendon has produced no shoulder disease in thirty below-elbow amputees subjected to biceps kineplasty for energizing a prosthetic device, at Walter Reed Army Hospital during the calender year 1950. Hansson has pointed out that "frozen shoulder" as just defined, frequently accompanies any painful condition of the upper limb; he stresses the need for reeducation in the use of the intrinsic shoulder muscles in this group of patients. It should be pointed out that the shoulder joint presents a relatively short lever arm energized by powerful, thick muscles which are prone to marked spasm and rapid atrophy. I have been impressed with the need for active relaxation of the shoulder girdle in these patients as suggested by Seidelin.

I certainly agree with Dr. Newman that the "frozen shoulder" is a rather common cause for severe disability and that its treatment is difficult. His operative results speak for themselves, although the number of reported cases is small and the follow-up on them is rather short. I should like to ask Dr. Newman how he selects the patient whose pathology is definite and what are his criteria for diagnosis of the surgical bicipital syndrome; what are the effects of procaine needling and has manipulation under anesthesia any place in the management of the condition. I again wish to compliment Dr. Newman on the clarity of his presentation and appreciate the opportunity to discuss his observations and results.

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* A presentation of illustrative cases surgically explored and of pertinent dissections of fresh autopsy material was given. This was very largely dependent upon projection of color lantern slides. Since black and white prints of color slides lose so much in the process of reproduction as to make them almost meaningless on the published page, it was thought wise to dispense with the publication of this part of the presentation.

THERAPEUTIC TEACHING *

Group Work in Physical Therapy

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and

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Rehabilitation, especially of the severely and chronically disabled has increased the patient load of most physical therapy programs during the past decade. Almost every month a new group, previously neglected or considered hopeless, is added to the ever increasing load requiring physical rehabilitation. Since the number of qualified physical therapists has not and cannot increase as rapidly as this patient load, it became obvious to many of us in the field that with our present methods of therapy, the saturation point would soon be reached. And indeed it has been reached in many good physical therapy programs throughout the country.

Too frequently good programs have been reduced to mediocrity because, for one reason or another, too large a case load had to be accepted. This has often resulted in disappointing results both from the viewpoint of the patient as well as from that of the medical unit.

In an effort to alleviate this present crisis, a number of institutions have utilized group work instead of individual treatment in certain phases of physical rehabilitation. At the New York State Rehabilitation Hospital, West Haverstraw, New York, the Physical Rehabilitation Section has attempted to do this by the organization of previously known techniques of group therapy into a single, effective working tool. We have designated this form of methodology for groups as "therapeutic teaching."

Therapeutic teaching may be defined as that form of physical therapy administered within a group situation in conformance with accepted pedagogical principles and fundamental concepts of rehabilitation. The lack of detailed instructional material set forth in logical, coherent sequence, has probably been the main factor in the retardation of the use of this method. One of the purposes of this paper is to furnish such detailed instructions. A second aim of this paper is to stress again the thought that the physical therapist must also be a teacher — especially in physical rehabilitation procedures. Guthrie-Smith[1] expresses the opinion that the physical therapist must ap-

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[1] Guthrie-Smith, Olive F.: Rehabilitation, Re-education, Remedial Exercises, The Williams & Wilkins Co., Baltimore, Maryland, 1943.

proach the patient as a teacher rather than as one who merely carries out a prescribed order of treatment. More colloquially, the successful therapist-teacher "works *with* the patient, not *on* him."

Controversy exists today concerning the problem of how the severely disabled individual may be best aided in achieving total independence in the functional physical activities required in daily living. The focus of attention in physical therapy has been centered on programs of individual therapy. We feel that this concept of individuality can still be maintained in properly organized programs of therapeutic teaching by emphasizing individual attention and instruction within any given group. We do not take issue with the fact that the best approach to therapy is on the individual basis. It is only when administrators are confronted with personnel shortages and excessive patient complements that group procedures are recommended.

Preparing and carrying out a therapeutic teaching program on a rational basis rather than chance, requires a plan for presenting an organized and progressively arranged body of functional exercises and activities. It should include a large range program or *rehabilitation syllabus,* and a daily program or *treatment plan.* The rehabilitation syllabus has as its purpose the assurance of a well-balanced physical rehabilitation plan in which consideration must be given to available facilities and equipment, staff personnel, time available for rehabilitation activities, and progressively increasing ability groups. The daily treatment plan, on the other hand, represents the therapist's own work sheet of therapeutic teaching procedure to be used, consistent with the needs of the individual patients in the group, at each level of progression from day to day.

Rehabilitation Syllabus

The rehabilitation syllabus offered in this paper (Tables 1, 2, 3, 4, 5, 6) represent the physical experiences the severely disabled will encounter in daily living. Its scope of planned experiences ranges from mat exercises to ambulation and functional retraining with wheelchair, braces, and crutches. The syllabus defines the various therapeutic groups, setting forth where one level ends and the next begins, which in actual administration must permit wide latitudes of overlap. Although in print, these groups would appear to be quite fixed and rigid, they merely represent flexible working guides in the preparation and administration of a daily treatment plan. The functional activities suggested in the syllabus are based on the "104 Daily Activity Test" listed by Deaver and Brown,[2] and may be modified or varied to meet the particular group situation with which therapists may deal.

This presentation is concerned only with the rationale of therapeutic teaching, and its program of various progressions to full physical rehabilitation. No reference is made to the physiologic aspects of the various exercises and activities used, the indications for their use, or even the results that may be attained. No attempt is made to describe or analyze the exercises or activities, or to justify the order of activities in the sequence of progression. The units of the syllabus of rehabilitation herewith presented (Tables 1, 2, 3, 4, 5, 6) were developed to meet the needs of the New York State Rehabilitation Hospital and is considered flexible enough to be offered as a basis or guide in building up a therapeutic teaching program to be adapted by others to their own situations.

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[2] Deaver, George D., and Brown, Mary Eleanor: The Physical Demands of Daily Life, published by the Institute for the Crippled and Disabled, New York.

TABLE 1. — *Mat Class. Aim: To Correlate and to Contribute, Through the Administration of Exercise Therapy, to the Development of the Individual in Attaining the Basic Strength, Flexibility, Coordination and Balance Necessary for Effective Mastery in Rehabilitation Fundamentals.*

Unit I. — Therapeutic Exercises.	Unit II. — Functional Exercises.[c]
Content.	Content.
Element A. General Exercises.[a] 1. Active Exercises. a. Flexibility Exercises (e. g., active stretching exercises, etc.). b. Strength and Endurance Exercises (e. g., movements related to big muscle activity, light dumbbell exercises, medicine ball activities, etc.). c. Coordination Exercises (e. g., elementary neuromuscular movements, etc.). d. Balance Exercises.	Element A. Lead-Up Functional Exercises.[d] 1. Lead-Up Functional Exercises Without Apparatus. 2. Lead-Up Functional Exercises with Apparatus. (e. g., sawed-off crutch exercises, bench exercises, etc.).
Element B. Specific Exercises.[b] 1. Specific Balance Exercises. a. Sitting Balance Exercises (e. g., use of small graded boxes for push-ups, dips, etc.). b. Kneeling Balance Exercises (e. g., use of graded benches for kneeling drills, etc.). 2. Sawed-Off Crutch Activities. a. Sitting Crutch Activities. b. Kneeling Crutch Activities. 1. Preliminaries of Learning to Break a Fall and How to Discard Crutches. 3. Standard Crutch Exercises: a. Crutch Drills. 1. Preliminary Crutch Training Performed in the Supine Position Using the Wall as a "Floor-Base."	Element B. Functional Activities.[e] 1. Moving 20 Feet on Floor in Other Than Erect Position. 2. Ascending and Descending Stairs Without Crutches and Braces. 3. To Floor from Wheelchair and Return.

[a] Through a prescribed program of kinesiologically sound exercises favorable to the best principles involving therapeutic exercises, the purpose of prescribed general exercises is to improve muscle tone, increase respiratory and vascular efficiency, and stimulate general metabolism.

[b] Prescribed specific exercises assume a rightful role of importance in rounding out the "conditioning" of the patient, which is predicated upon the development and amelioration of specific neuro-muscular and muscular-skeletal dysfunctions or weaknesses not reached through prescribed general exercises.

[c] The use of prescribed functional exercises in the mat class is for the purpose of developing facility and independence in certain daily activities which are considered a problem for the patient commensurate with his existing level of recovery or retraining. Functional exercises are of two types, lead-up functional exercises and functional activities.

[d] Lead-up functional exercises are those isolated fundamental movements of a particular daily activity which, if properly used, will lead to increased ability to perform the whole activity.[3]

[e] Functional activities are herein regarded as those selected essential activities for daily living commensurate with the patient's contemporary abilities which, more than likely, he will have to master for independent living.

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[3] Hoberman, Morton; Cicenia, Erbert F.; Dervitz, Hyman L., and Sampson, Oscar C.: The Use of Lead-up Functional Exercises, The Physical Therapy Review 31:321 (Aug.)1951.

Treatment Plan

The daily treatment plan is a combination of activities, selected from the syllabus of rehabilitation, in accordance with patients' present needs, interests, and abilities. The activities comprise a single treatment period with a proportionate amount of time allotted to each activity. The daily treatment plan is prepared in writing by the therapist for each group and should be subject to approval by the supervisor. In planning a daily program the therapist should select activities from the various elements of the units, so as to give a well-balanced development. The importance of writing out programs in advance cannot be overemphasized. The specimen plan which follows (Table 1[1], p. 544) merely suggests a method which may be used.

TABLE 2. — *Wheelchair Class Aim: To Make the Individual as Independent as Possible in Certain Selected Essential Wheelchair Activities.*

Unit I. — Activities Without Braces.	Unit II. — Activities with Braces.
Content.	Content.
Element A. Wheelchair Management. 1. Controlling Footrests. 2. Controlling the Wheelchair. a. Propelling (e. g., over doorsills, carpets and rugs, up and down ramps, etc.). b. Turning. c. Opening and Closing Doors from Wheelchair. Element B. Daily Activities with Wheelchair. 1. Moving from Bed to Wheelchair and Return. 2. Moving from Chair to Wheelchair and Return. 3. Moving from Wheelchair to Toilet and Return. 4. Moving from Wheelchair to Bathtub and Return. 5. Moving from Wheelchair to Car and Return. a. Management of Wheelchair Into and Out of Car.	Element A. Daily Activities with Wheelchair. 1. Moving from Bed to Wheelchair and Return. 2. Moving from Chair to Wheelchair and Return. 3. Moving from Wheelchair to Toilet and Return. 4. Moving from Wheelchair to Car and Return.

TABLE 3. — *Parallel Bar Class. Aim: To Develop Levels of Proficiency Within the Individual in Pre-Ambulation and Pre-Crutch Fundamentals, and to Continue Specialized Work Emphasizing the Development of Those Elements (Strength, Balance, Coordination) Necessary for Such Activity.*

Unit I. — Therapeutic Exercises.	Unit II. — Functional Exercises.	Unit III. — Elementary Gait Patterns.	Unit IV. — Crutch Bar Drills.[f]
Content.	Content.	Content.	Content.
Element A. Specific Exercises. 1. Push-Ups. 2. Hip Raising and Leg Swinging. 3. Special Resistive Exercises (e. g., for hypertrophy of the lower trapezius and latissimus dorsi. (4.)	Element A. Balance Exercises. 1. Point of Balance (e. g., correct standing posture and stance). 2. Body-Weight Shifting. Element B. Pre-Elevation Drills. 1. Stair and Curbs (e. g., utilizing different sized benches or stools placed between the parallel bars).	Element A. Forward Gaits. 1. Drag-to Gait. 2. Swing-to Gait. 3. Swing-Thru Gait. 4. Four-Point Gait. Element B. Backward Gaits. 1. Four-Point Gait. 2. Back "Jacks." 3. Swing-Thru Gait. Element C. Sideward Gait. 1. Four-Point Side Step. 2. Two-Point Side Step.	Element A. Balance Exercises. 1. Crutch Stance. a. Point of Balance. 2. Balance Drills. 3. Body-Weight Shifting. 4. Crutch Placement.

[f] Preliminary crutch management elements are presented by use of wide parallel bars, permitting freedom of independent movement and at the same time affording the patient safety until he has the necessary confidence to progress to crutch management outside the bars.

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4. Abramson, Arthur S.: Principles of Bracing in the Rehabilitation of the Paraplegic, Bull. Hosp. Joint Dis., Vol. X, No. 2, October, 1949.

TABLE 4. — *Crutch Management Class.*[g] *Aim: To Firmly Establish Gait Patterns Preparatory to the Teaching of the Beginnings of Endurance as Well as Stress the Mastery of Certain Daily Activities Consistent with This Stage of the Patient's Level of Retraining.*

Unit I. — Crutch Stances.	Unit II. — Gait Training.	Unit III. — Functional Training.
Content.	Content.	Content.
Element A. Establishing the Point of Balance. 1. Posture and Stance. Element B. Balance Activities. 1. Balance Drills. 2. Body-Weight Shifting. 3. Crutch Placement.	Element A. Forward Gaits. Element B. Backward Gaits. Element C. Sideward Gaits. Element D. Pivoting and Turning.	Element A. Daily Activities. 1. Sitting Down and Getting Up from Varied Sized Chairs. 2. To and from Bed with Crutches. 3. To and from Toilet with Crutches. 4. Getting Down and Up from Floor. a. With Help (e. g., assistance of second person, articles of furniture, wall, door, etc.). b. Without Help. 5. Elementary Falling Techniques.

[g] In order to facilitate the patient's advancement to an ambulatory status, an intermediate level between parallel bars and complete ambulation has been established in the form of a prescribed crutch management class.

TABLE 5. — *Progressive Ambulation Class.*[h] *Aim: To Begin the Preliminaries of Endurance for Physical Activity by Gradually Developing the Patient's Ambulatory Endurance to Five Hundred Feet Within an Acceptable, Practical Length of Time Without Undue Fatigue, and to Teach Daily Activities Commensurate with This Level of Progression.*

Unit I. — Ambulation.	Unit II. — Functional Activities.
Content.	Content.
Element A. Elementary Endurance Activities. 1. Progressive Development of the Individual's Capacity to Ambulate Approximately 500 Feet in a Practical Length of Time Without Undue Fatigue.	Element A. Daily Activities. 1. Opening and Closing Doors. 2. Passing Through a Revolving Door. 3. Passing Through a Turnstile. 4. Ascending and Descending Ramps. 5. Ascending and Descending Stairs with Handrail. 6. Ascending and Descending Curbs. 7. Ascending and Descending Stairs. Without Handrail. Element B. Advanced Falling Techniques.

[h] Until this point the program has been concentrating on the acquisition of the necessary strength, balance, coordination, and mastery of skills which facilitate the handling of the body efficiently. Progressive ambulation aims to utilize these learned skills in the development of endurance and tolerance for physical activity.

TABLE 6. —*Endurance Class.*[i] *Aim: To Develop the Maximum Ambulatory Endurance of Which the Individual Is Capable and to Improve Tolerance in Elevation and Traveling Activities with a View Toward the Complete Severance of the Individual From Dependence Upon a Wheelchair in Accordance with the Limits Imposed by the Disability.*[j]

Unit I. — Ambulatory Activities.	Unit II. — Elevation Activities.	Unit III. — Traveling Activities.	Unit IV. — Endurance Activities.
Content.	Content.	Content.	Content.
Element A. Locomotion Progressions.	Element A. Climbing Progressions.	Element A. Traveling Progressions.	Element A. Total Endurance.
1. Ambulate to and from Rehabilitation Clinic and the Ward. 2. Ambulate About the Various Corridors of the Hospital. 3. Ambulate ¼ of a Mile. 4. Ambulate ½ of a Mile. 5. Ambulate One Mile.	1. Ascending and Descending Flights of Stairs. 2. Ascending and Descending Bus Steps. 3. Ascending and Descending Train Steps.	1. Crossing Street with Traffic Light. 2. Sitting Down and Getting Up from Theatre Seats, Restaurant Booth, Bar Stool, Etc. 3. Picking Up and Carrying Objects.	1. Carry on a Program of Normal Activities Without a Wheelchair for Progressive Periods of Time (e. g., two hours, four hours, six hours, eight hours, until bedtime, etc.). 2. Obstacle Course of Functional Activities. (Determined by the individual needs, interests, and abilities of the members of the group.)
		Element B. Automobile Activities.	
		1. Moving to and from Automobile with Braces and Crutches.	
		Element C. Travel Test.	
		1. Travel Test Activities.[k] (Determined by the individual post-hospitalization needs of the members of the group.)	

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[i] The concern at this level, is not solely with the elements of distance and speed (e. g., ambulate specified distances in a reasonable time), as is the goal of the prescribed progressive ambulation class, but also with the element of capacity (e. g., carrying on a program of normal activities without the use of a wheelchair for two hours, four hours, etc.) depending upon the patient's needs and abilities.

[j] When the patient is ready for the endurance level, he should have more or less reached a plateau in the process of retraining the physical residuals of the disability. In other words, at the endurance level, the patient has developed the strength and acquired fundamental techniques commensurate with the extent of involvement, but now requires practical application of such power and knowledge to specific conditions. Here, attempts are made to progressively do without the wheelchair for increasing periods of time. Instead of climbing a few practice stairs, the patient works to develop the endurance needed to climb *flights* of stairs and experiments with a myriad of types of steps, stairs, and staircases. The patient's home and vocational situation is reviewed, and special endurance, elevation, and travel experiences are set up to simulate the contemplated post-hospital needs of the individual and/or the group.

[k] Travel Test: As a climax to the functional retraining program, patients (when indicated by the physician concerned) are taken into "town" and given the opportunity to find out for themselves just what they can and cannot do in practical everyday situations away from the protective and secure hospital environment. With a therapist acting as a guide, the travel test, except for minor variations according to specific individual needs, consists of the following itinerary: Hospital to train depot via hospital station wagon . . . purchase train ticket and board train to the next station . . . bus or taxi to the center of town . . . shopping tour offering a variety of "true-to-life" experiences to be performed as independently as possible . . . return to hospital via public vehicles of transportation.

Classification of Patients

For practical administrative purposes, when a patient is admitted to the Physical Rehabilitation Section, the physician in charge places the patient in one of the five rehabilitation categories based on test results (e. g., muscle test, daily activity test). These are (1) *ambulatory patients* (A) — patients who are or have the potential for complete ambulation and independence with or without braces and crutches, (2) *wheelchair patients* (W) — patients who must, or eventually will spend all their time in a wheelchair, but are capable of performing most or all the essential activities of daily living independently, (3) *predominantly ambulatory* (PA) — patients who are able or will be able to independently

Table 1.[1] — *Daily Treatment Plan.*

Date: 7/11/51. Time: 3:00-3:45 P. M. Therapist: Marino.
Activity: Crutch Management Class.

PATIENTS.	REHABILITATION CATEGORY.
Howell, B.	P. A.
Brown, R.	P. A.
Draznk, A.	P. W.
Lugar, T.	A.
Frey, F.	P. A. (New Patient).

A. WARM UP AND PREPARATORY MOVEMENTS — 5 Minutes.
H. B. D. and L. — General Balance Drills and Crutch Placement Activities.
Frey — Indoctrination, Teach Crutch Balance Stance.

B. REVIEW — 15 Minutes.
H. B. D. and L. — Review Turning and Pivoting Movements. Teach Four Point Gait Fundamentals Forward and Backward; Check Lugar on Gait Patterns.

C. NEW MATERIAL — 20 Minutes.
All Patients — Explain and Demonstrate Fundamentals of Sitting Activities.
Have All Patients Except Frey, Perform Activity Under Supervision.
Frey — Teach Crutch Balance Drills.

D. PRACTICE — 5 Minutes.
Howell and Brown — New Material.
Draznk — Pivoting and Turning. Also New Material.
Lugar — Four Point Gait, Increased Cadence.
Frey — Balance, Stance, and Drills.

perform a majority of ambulatory or functional activities with or without braces and crutches, but for whom it is acceptable and practical under certain circumstances to use a wheelchair, (4) *predominantly wheelchair* (PW) — patients who can or will be able to do some ambulatory activities independently or with a minimum of assistance, but will require a wheelchair for the greater portion of their daily activities, and (5) *predominantly custodial* (PC) — patients who may be able to sit in a wheelchair or even stand upright in braces and with crutches for physiological reasons, but who are completely dependent upon attendant care for help in most or all daily activities, and will remain so.

It is emphasized, that the placing of a patient in one of these categories is meant as a guide to treatment and is not to be construed as being a permanent, fixed prognosis. During the stay of a patient in the hospital his category may be changed from "W" to "PW" (rarely does the patient whose original category is "PC" progress much beyond "W"). We are of the opinion that this type of classification is of definite value in grouping patients for therapeutic teaching, as well as assaying his present potential for the therapist. It is a motor estimate, which may be used by the therapist for determining a more accurate knowledge of the individual within the group.

It will be noted that the rehabilitation syllabus has been organized in units and elements. Since the unit involves considerable activity and individual participation in the group, a formal approach to handling the group will not succeed, and will probably decrease the effectiveness of activities presented. If the syllabus provides activity, then the method of presentation must allow for that activity. The best way to obtain the active participation outlined in the syllabus is through an informal and friendly approach which permits patients to exercise at their own pace, disregarding unified movements or strict cadences. The informal approach provides opportunity for individual group members to make progress consistent within their limitations. This is opposed to the formal approach which progresses the group as a whole, as though each patient in the group had equal abilities and potentialities.

When planning a program and selecting activities, it is of vital importance that due consideration be given to the patient's physical limitations, as well as to choice of activities which will afford the patient a sense of achievement or improvement from day to day. After a few months in a hospital a patient can feel quite routinized, and it is essential that activities be planned so as to keep abreast of any improvement. This implies leaving an activity before it becomes monotonous to the individual. A varied program is essential, not only to avoid boredom, but positively to sustain interest. Since review is a part of all therapeutic teaching units, any points of finesse can be achieved later by practice, interspersed repetition, and re-emphasis.

Size of the Therapeutic Teaching Groups. — In the interest of an efficient program the classes are conducted in small homogeneous ability groups, with the activities for each group prescribed or approved by the physician in charge on the basis of personal needs. The *mat class* should be limited to a *maximum of eight to ten patients.* The functional activity groups such as parallel bar class, wheelchair class, etc., should be limited to a *maximum of six to eight patients.*

Conducting the Program. — In considering the problems of assuming the role of "therapist-teacher," and the actual teaching of the program, the physical therapist should not adhere to rigid rules of administering prescribed exercises and activities, but should *individualize* wherever possible. It is suggested that he employ the "explanation-demonstration-participation" method of teaching, if feasible, for any given situation. By this is meant that the therapist gives a brief verbal description and explanation of the exercise or activity to be taught, followed by a demonstration of the movements either by the therapist or some advanced patient within the group who has perfected the technique. When it comes to actual participation in the activity by the group, management can be placed on an individual or on a group performance basis. In other words, the activity may be such that it permits the entire group to perform the movements together, exercising at will (e. g., crutch balance, walking for endurance). On the other hand, the activity may be so complex or the safety factor so great (e. g., up and down stairs) as to require individual performance by one patient under the immediate supervision of the therapist while the other members of the group engage in preparatory or lead-up movements. Observation of patients during the practice period at the end of the treatment period will usually give the therapist clues as to which patients require more individual instruction the next day.

Advantages of Group Work

Other than administratively permitting sound therapy to relatively large case loads with limited personnel, group instruction is found to provide an "interest-method" of learning functional rehabilitation skills. Through socialization with other patients and the manifestations of mild, friendly rivalry with a neighbor which borders on emulation rather than competition, a large amount of recreational value is combined with therapeutic activities. We feel this has rewarded our hospital with an unusually high spirited morale among the patient population. Krusen[5] made a similar observation on a recent medical lecture tour of Europe when he reported a tendency in London hospitals to group patients for class work in therapeutic exercises. He felt that the psychologic advantages in group exercises warranted the attention of American physicians and therapists to such procedures.

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[5] Krusen, Frank H.: Physical Medicine and Rehabilitation in Europe, Arch. Phys. Med. 32:10 (Jan.) 1951.

The variability, scope, and vigor of the functional activities program has been augmented many times over through the inception of therapeutic teaching. The way to master ambulation and daily activities essential to physical independence is through arduous practice and repetitious review of the basic elements or fundamentals of physical rehabilitation. Therapeutic teaching, which is based upon *instruction, practice, testing,* and *review,* affords the opportunity for supervised and repeated practice and review. Because of the facility in scheduling, patients can now receive as much as three, four, five or more varied treatments a day, if these are medically indicated and tolerated. In a strict, formal individual program with one therapist treating one patient, the patient would receive, crowded into a single treatment period, mat work, wheelchair activities, standing and ambulation, and functional activities.

Scheduling, which is a cooperative function among all the services required to treat the patient, is less a problem than it was before the introduction of therapeutic teaching. Group work permits greater utilization of the patient's available time, to the extent of individual needs and capabilities, for treatment and rehabilitation in physical therapy. For example our rehabilitation schedule provides four therapeutic teaching classes for each level of progression, which is ample for our present programming needs. So, if it is impossible to schedule a patient at one particular time for an activity, we have three alternative periods to consider.

Disadvantages of Group Work

Admittedly, the greatest disadvantage of therapeutic teaching is the reduction of individual attention in the administration of therapy. However, in terms of the over-all physical rehabilitation program, this is not so great that it outweights the advantages. The point of view of Ross[6] seems eminently sound when he said, "while all learning is individual learning, it can take place in a group setting; for the individual not only learns *in* the group, he learns *from* the group as well."

While we emphasize therapeutic teaching as one kind of group organization which provides for individual learning, we consider it only an adjunct method. We do not mean to imply that therapeutic teaching supersedes individual programs. At the New York State Rehabilitation Hospital, patients who are too severely involved to fit into any of the groups are treated entirely on an individual basis. Others are treated individually until such time as it is medically indicated that they can progress to therapeutic teaching levels. By constant testing and reevaluation of the patient, physical experiences can be well guided, assuring a proper balance in development and skill, thus offsetting, to an extent, the one big disadvantage of group instruction.

Summary

Simply stated, therapeutic teaching is defined as group procedures in physical therapy and rehabilitation. Planning is essential if therapeutic teaching programs are to function in accord with sound physiological and psychological principles. This entails the use of a rehabilitation syllabus (long term program) and daily treatment plans (immediate programs). Properly prescribed and administered, therapeutic teaching can be a successful method of attaining levels of proficiency in rehabilitation fundamentals, as well as a means of maintaining acquired skills.

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[6] Ross, C. C.: Measurement in Today Schools, Prentice-Hall, Inc., New York, 1947.

Discussion

Dr. Harry Kessler (Washington, D. C.): This presentation is most pertinent and timely as a consideration of the increasing demands upon a professional technical group which cannot now nor for many years to come make available the number of adequately trained physical therapists required to fully meet the needs.

Please note that the authors have emphasized the fact that the activities outlined should not be construed as the answer to the problem of the overloaded clinic under all circumstances. There has been presented, however, a manner of approach which, intelligently applied under appropriate circumstances, may do much to alleviate the strain created by a disproportion between work load and available physical therapists.

Obviously, the large general hospital, with its diversification in types of patient under treatment, may not lend itself so readily to this method of approach; yet even here the exercise of imagination and ingenuity may serve to group certain classes of patients in the manner outlined.

The authors recognize the difficulty entailed by the lack of complete individualization of the treatment under these circumstances. However, with the proper approach to the patient on the part of the therapist, a factor which is extremely important under any circumstances and even more so in this situation, and with the careful selection of patients for specific groupings, this difficulty may be minimized.

I should like to mention that we in the Veterans Administration, in many instances, at least, have partially solved the problem of the overtaxed physical therapy clinic by full utilization of the abilities of the corrective therapists. In my own experience, and in the experience of others, the results achieved by these therapists have been most gratifying, and have broadened the scope of available therapy over and beyond what would have been possible if we had to depend solely on the number of physical therapists at our command. Even so, we have been faced frequently with the need for group approach in therapeutic procedures and at times advantageously so when re-socialization became one of the objectives.

RESISTIVE EXERCISES IN THE TREATMENT OF POLIOMYELITIS *

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It is evident that the goal in rehabilitating the post-acute poliomyelitis patient is realization of maximum residual capacity. It is equally obvious that to attain this goal there should be a well defined program leading up to actual training in functional activities. When the patient is left with definite muscular weakness, a system of exercises should be established that will gradually recover all remaining strength possible. The most efficient method known today for strengthening weakened muscles is progressive resistance exercise. This presentation will attempt to point out the relative importance of progressive exercises throughout the treatment program of the poliomyelitis patient with residual weakness, following the acute episode.

In the post-acute and occasionally during the acute period the therapist will administer passive exercises; this is primarily a mobilization procedure. At some subsequent time she will call upon the patient to help her move the affected part through a painless range of motion and should a contraction be elicited while moving through the desired range assistive exercise will have been initiated. In early assistive exercises or muscle re-education, the therapist will gauge the tempo of the assistive exercise so that the contraction will be sustained throughout the range. There must be perfect cooperation and coordination between the patient and therapist. Should the tempo be too fast there would be little or no load involved and consequently the elements of exercise will be lost; should the tempo be too slow, an overload would be established which will discourage the contraction and may well encourage incoordination. The result in this type of manual exercise will depend directly upon the skill of the therapist. With proper technique she not only will develop coordination, which is of primary concern, but will also increase the strength in the exercised muscle groups. The gain in strength is accomplished by gradually and progressively offering less assistance over a period of time. This is a manual application of progressive resistance exercises.

When coordination has been well established there are more efficient methods available to carry on and concentrate on progressive resistance exercises. These include the use of weights and counter balances,[1-2] and underwater resistance exercises.[3] If a pool is available both methods can be used. Generally it is more efficient and effective to exercise muscle groups less than "fair" in a water medium, while heavy resistance is better employed through utilization of weights. The most important factor in determining the choice in any instance is the skill of the operator in utilizing the method.

In prescribing progressive exercises for specific muscle groups it is important to concentrate on activities that will contribute the most toward maximal function. In this respect, important units in the lower extremities are the large weight-bearings groups. In the upper extremities, the hand

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* Summary of Presentation given for the Seminar in conjunction with the 28th Annual Scientific and Clinical session of the American Congress of Physical Medicine in Boston, August, 1950.

† Medical Director, Gonzales Warm Springs Foundation, Gonzales, Texas.

1. De Lorme, T. L.: Restoration of Muscle Power by Heavy Resistance Exercise, J. Bone & Joint Surgery 27:654, 1945.

2. De Lorme, T. L., and Watkins, A. L.: Techniques of Progressive Resistance Exercises, Arch. Phys. Med. 29:263, 1948.

3. Schram, D. A., and Bennett, R. L.: Underwater Resistance Exercises, Arch. Phys. Med. 32:222, 1951.

is of primary concern, followed by shoulders and body elevators. In the trunk, the lateral abdominals and quadratii are important especially for balance and gait. It should be emphasized that in selecting the muscle groups for exercise one should choose those that have a residual weakness but present possibilities for some degree of return to functional strength.

It will be found after a variable period of time that the gain in strength in the specific muscles exercised on a Progressive Resistive Exercises program will gradually decrease. This "leveling off" of return of strength is an indication for a change in the program.

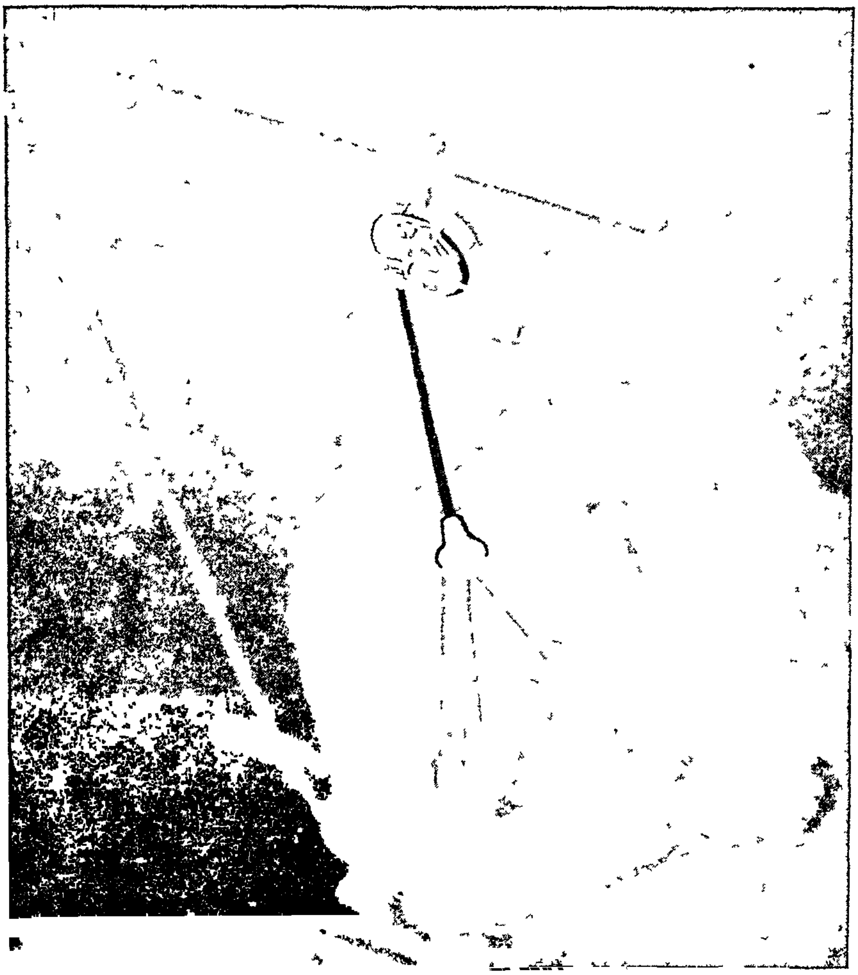

Fig 1. — Spring Unit illustrated is from that used for the carriage return on an Underwood typewriter. A housing is applied over the unit and a crank handle is welded to the adjustment screw. There is no significant variation in tension throughout the useful range A fish scale or a more accurate type of force indicator mechanism can be used to check actual tension for case records.

Whereas the emphasis heretofore has been on individual units, the objective now becomes the performance of specific useful acts, utilizing all groups concerned in the functional exercise. In this part of the program, the patient may need braces and support for protection and stabilization as well as for assistance in function. In some specific instances it is possbile to use special apparatus which will assist in the performance of a functional activity. An example of an assistive device for the abductors of the upper extremities is overhead slings with an adjustable coiled spring (Fig. 1). The tension is adjusted for assistance to do a functional act in abduction. As the abductors gain in strength, the tension in the spring is gradually decreased.

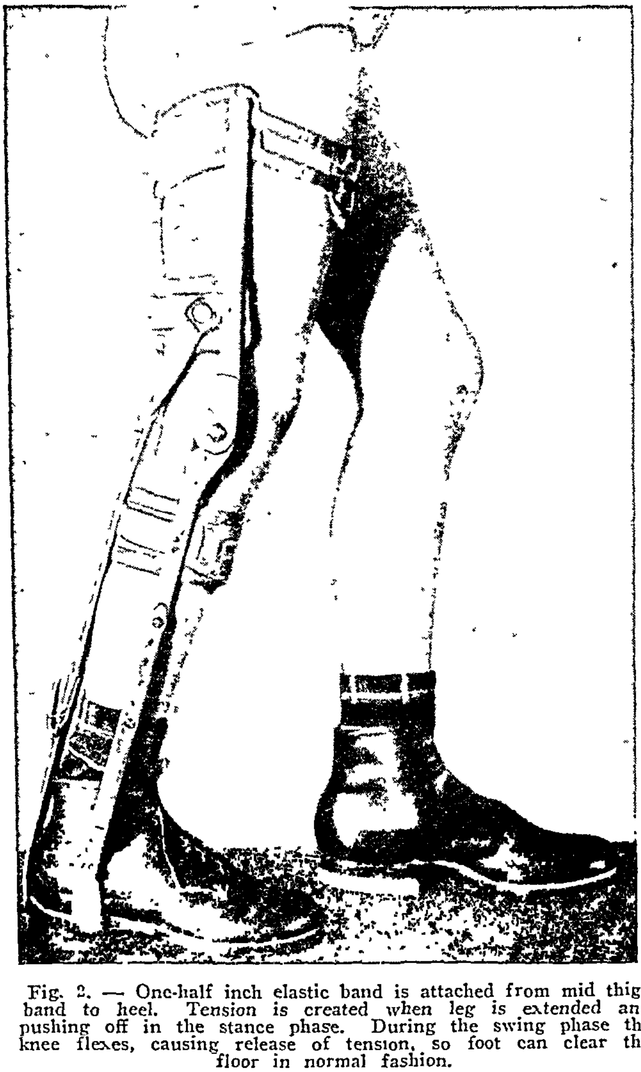

Fig. 2. — One-half inch elastic band is attached from mid thigh band to heel. Tension is created when leg is extended and pushing off in the stance phase. During the swing phase the knee flexes, causing release of tension, so foot can clear the floor in normal fashion.

In the lower extremities a good example of assistance is a gastroc-soleus band attachment on a long leg brace (Fig. 2). Here the assistance is created each time the patient extends his leg to push off. Adjustments can be made at the attachment in the heel, and tension on the elastic band can gradually be decreased. It is generally found, however, that the elasticity lost in regular use is sufficient to compensate for a gradual progressive decrease in assistance.

Another example is the short leg brace (Fig 3) to assist non-functional dorsi-flexors of the foot. Leaves of spring steel that support the foot can be removed one at a time as the strength in the dorsi-flexors increases.

The amount of activity should be well graduated when using assistive devices in the functional program. The reserve strength, especially endurance, is relatively small in muscle groups weakened by poliomyelitis. Any weight-bearing group in the leg that has slightly better than functional strength will perform adequately for short periods only. If the optimum amount of walking for the specific case is exceeded, a limp will appear, in which case either the walking distance should be decreased or the assistive force increased.

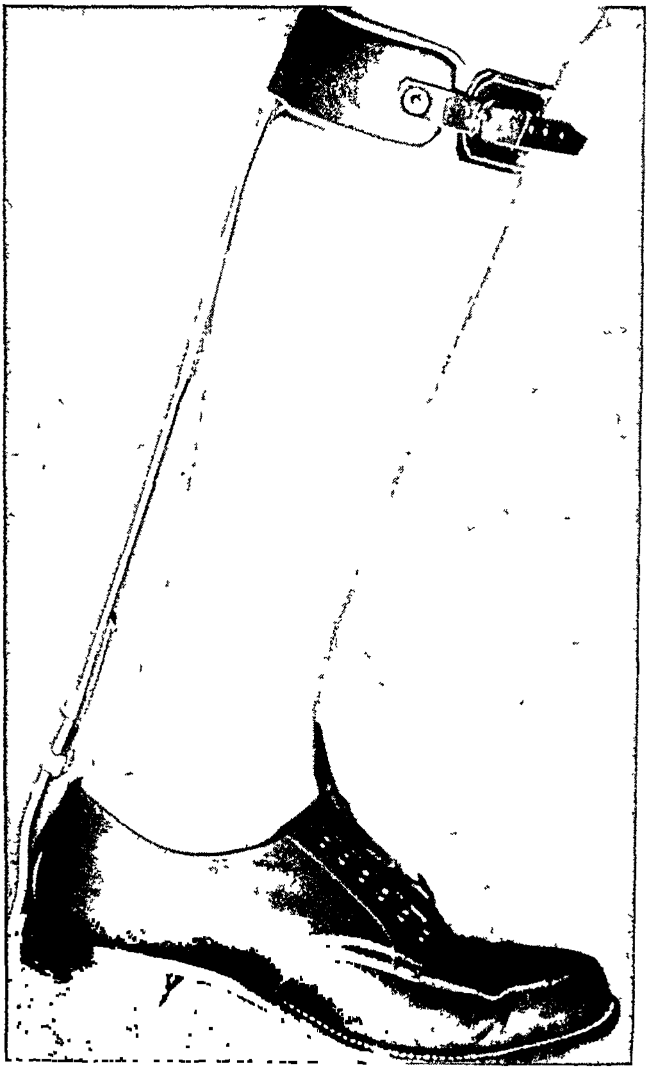

Fig 3 — Commercial short leg brace showing leaves of spring steel in posterior region near ankle Good lateral stability is necessary with this type of brace, and it is not practical for children or others who will exert more than a moderate amount of stress in daily usage

Conclusion

A concept has been presented that suggests three principal phases in an exercise program in post-acute poliomyelitis. Progressive Resistance Exercises are an integral part of this program with a minor emphasis on the early and final periods, and primarily emphasis on the intervening phase.

FUNCTIONAL SHOULDER AND UPPER EXTREMITY BRACE-APPARATUS

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Shoulder disabilities, very common in many classes of medical practice, represent a high percentage of the cases referred to Physical Medicine and Rehabilitation. As a large number of these cases are ambulatory, it appears necessary to revise the usual methods of treatment. The goal desired was support in the most advantageous position, with gravity eliminated as much as possible, and the brace apparatus so designed that active and passive motion in all directions could be obtained with the least possible muscular effort. The brace apparatus described in this paper was developed, and it is believed that it can be gradually improved to provide the necessary requisites.

It is possible that the brace apparatus can be used with beneficial results in a large group of shoulder disabilities where the residual disability, regardless of original etiology, is so often caused or aggravated by the gravity — position drag upon the shoulder joint structures, articular surfaces, capsules, bursae, tendons, muscles, nerves, and blood vessels. The two most important requisites are support and motion with minimum effort. These requisites must include: (1) counteraction of gravity; (2) maintenance of advantageous position; (3) facilitation of natural functional motions, with return to original position; (4) light weight, supported on the pelvis (to prevent scoliosis when used unilaterally); (5) minimal mechanical resistance to minimal muscular force; (6) the facilitation of the use of passive swing-motion exercise.

Specifications

A plaster-mold form is first made for use in constructing the brace apparatus. A weight bearing pelvic band is formed to fit snugly over the crest of the ilium. A chest band is then formed. The bands are made of 24 surface tension (0.064 thickness) alloy aluminum, lined with felt and covered with Kalistron (washable plastic). The two are connected with a mid-axillary side bar of 24 surface tension alloy aluminum (⅝ inch width and 3/16 inch thickness). Webbing straps are attached to each — one around body, one from chest band over opposite shoulder. An over-shoulder aluminum strap is then molded to clear the disabled shoulder about ½ inch and sufficiently away from the body to clear body movements. It is made of 24 surface tension half-round alloy aluminum and attached to chest band by rivets in such a manner that the strap is just medial to the center of the shoulder joint, at which point a hole is drilled to receive the end of a 2½ to 3 inch steel tubing, the diameter of the tubing being dependent upon the weight to be supported — usually ¼ inch up. Before insertion a small section of steel strap is welded to the end of the tubing, the strap is bent to conform with the shape of shoulder strap and after insertion of the tubing the two straps are riveted together so that the tubing is perpendicular to the floor. A stainless steel rod (¼ inch or up) is bent at right angles; one end of the rod is cut to be inserted to rest upon the bottom of the tubing with sufficient length to clear the top of the tubing; the rod is then cut at arm length, where a polycentric or single hinged stainless steel joint is made for the elbow. Sufficient rod (maybe of smaller diameter) is then attached to over-reach the wrist slightly. Springs of sufficient length and strength to overcome gravity and yet give ample functional stretch to the arc supported are attached to the arm and forearm rods. The springs are attached to perforated leather cuffs for support of the arm and forearm, and a felt ring with thumb and dorsal eyelets work well for two functional positions of hand support. In making the springs music steel wire is used (size 18 gauge and up), the length and diameter of the spring depending upon the amount of motion desired; the gauge by the weight to be supported. Various spring attachments are used to give full and free motion, yet supply adequate elbow flexion and counterflexion. They may be crossed from upper forearm to lower arm when more flexion is desired. The amount of arm abduction needed will depend on the condition to be treated; generally, about sixty degrees is preferred. The springs are attached to the rods by drilled holes or soldered and to the cuffs by eyelets; they may be electroplated after proper fitting is accomplished. Button holes may be made in clothing which will allow it to be slipped on over the tubing. When needed for both upper extremities, the bands are continued posteriorly and a hinged joint connection is made. The brace apparatus then can be slipped on as a vest. For small narrow width shoulders, it may be advantageous to use a small length tubing and make a double bend offset in the arm rod so as to clear head movements.

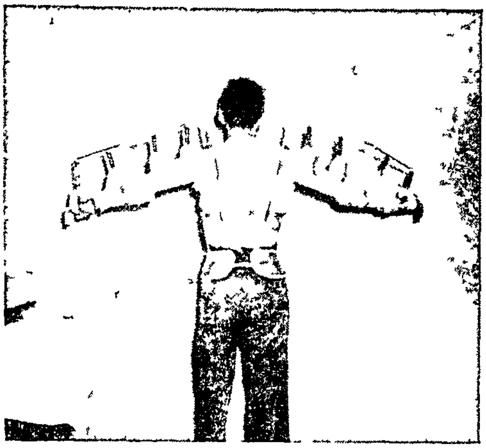

Fig 1 — Bilateral Brace Apparatus for Poliomyelitic Paralysis of Both Upper Extremities *Comment* This white male, aged 26, contracted poliomyelitis August 17, 1951, and was admitted to our hospital September 6, 1951. He showed only fair response to muscle re-education up until the time the bilateral shoulder splint brace was applied at which time he was discharged and reported back at intervals. Muscle function tests made at end of one and two months showed remarkable improvement in function, and he was able to return to work as chemist at the end of six weeks At the end of two months he was able to do full time work which required overhead reaching of both extremities in removing and replacing chemical bottles from high shelves While his deltoids have only reached fair plus level of function the other muscles of the upper extremities rate good and good plus

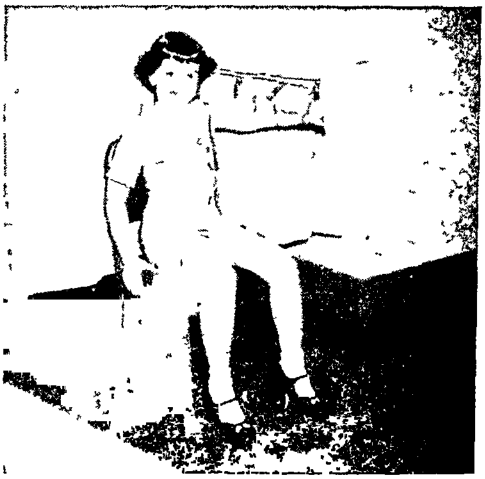

Fig 2. — Unilateral Brace Apparatus for White Female with Paralysis of Left Upper Extremity *Comment* This white female, age eight, had onset of poliomyelitis May 29, 1951 After recovery of the acute stage she had fair minus function of trapezius, serratus magnus, rhomboids, and lattissimmus dorsi, and the remainder of the muscles only showing zero to trace with the exception of the flexor profundis and sublimis digitorum showing poor function The functional shoulder splint was applied to the left upper extremity on October 5, 1951. She has shown slow but gradual improvement Muscles of the arm have improved slightly, and muscles of the forearm and hand have shown remarkable increase from zero and trace to poor and poor plus Functional use good.

Uses

Properly fitted, this unilateral brace apparatus should not disturb even the polio-weakened backs. Very little muscle power is needed to motivate the ordinary functional movements. Walking will be accompanied by vertical swinging motion. The extremity or extremities may be folded compactly for passing through narrow openings. Various modifications will be found necessary: for example, in very small children where the springs are not feasible, the tubing hinge is mounted on the side bar or corset crutch bar, the elbow hinged and hand supports used. It may be necessary to limit the extension movement of the shoulder or elbow. This may be done with a leather tubing check across the angle. Likewise, if flexion needs restriction, a wooden stick of desired length can be inserted in the leather tubing. In using the brace apparatus it is suggested that the device be kept on for gradually increasing intervals during the first week.

Based on the findings so ably brought out by Yamshon:[1]

> "Spasticity in the muscles of the arm is influenced primarily by the position of that arm. It can be demonstrated that the spasticity can shift from the flexors to the extensors, when the relationship to each other of the muscles around the shoulder girdle is altered. All other reflex influences, in the hemiplegic man at least, are superimposed upon this primary postural pattern. When the arm is at the side, the increased tone is found in the flexors. If the arm is elevated to 90 degrees or above, it can be noted that the tone will shift from the flexors to the extensors."

It is believed that, supporting the arm in the brace apparatus at about sixty degrees abduction, this reflex spastic contraction can be reduced to a minimum by placing the shoulder muscles in better relation to each other; by eliminating stretching of tendons, muscles, nerves, and blood vessels through a narrowed rigid opening; and by permitting active, passive, and spring-motion exercise. These would reduce reflex irritation (sympathetic stimulation) and give better blood supply and muscle tone, thereby hastening the return to voluntary control with increased abduction and external rotation.

The brace has only been in use for a short period, and, as yet, only on poliomyelitic paralysis cases. The results thus far have been very encouraging, especially, where groups of shoulder muscles had remained static for some time. In a joint where stability is sacrificed for mobility, it is believed the brace apparatus can be used beneficially in all forms of shoulder disabilities, where functional support, active and passive exercise, abduction, and external rotation are needed.

It has been found to greatly accelerate functional recovery in poliomyelitic paralysis of the shoulder where the patients are not bedridden. Where the shoulder is practically flail, it may be necessary to add two guy straps to aid in holding the head of the humerus well in the glenoid fossa. After a short period these straps have been discarded. The brace apparatus has been found very beneficial in cases of flail shoulder with a functioning forearm or hand — enabling performance of good functional movements. Every one is familiar with the benefits derived from the overhead spring suspension supports attached to the back of a wheel chair. This brace apparatus can also be used in ambulatory cases and will give more definite support and more normal functional motion. Although it is still in the experimental stage, it is hoped that the brace apparatus will contribute to the development of better functional bracing for disabilities of the shoulder and upper extremity.

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[1] Yamshon: "Position of the Arm in Spastic Hemiplegia," Arch. Phys. Med. 31:658, 1950.

Acknowledgment. — The author wishes to express most sincere appreciation and thanks to Mr. George Lambert of Snell's Limbs and Braces, Inc., of this city for his assistance and cooperation in the development of this brace apparatus.

MEDICAL NEWS

Members are invited to send to this office items of news of general interest, for example, those relating to society activities, new hospitals, education, etc. Programs should be received at least three weeks before the date of meeting.

Personals

Dr. **George D. Wilson**, Asheville, N. C., recently received an Award of Merit from The Citizens Committee for the Hoover Report. Dr. Wilson was Chairman of the Section on Physical Medicine, Advisory Board of The National Doctors Committee, an affiliate of The Citizens Committee.

Park A. Deckard, Harrisburg, Pa., has recently retired from the staff of Harrisburg Hospital. He will remain as a consultant of the hospital and will continue his private practice.

At the Kessler Institute for Rehabilitation, West Orange, N. J., a conference on the rehabilitation of paraplegics will be held on October 10. Dr. **Arthur S. Abramson** will act as Secretary of the Neurology panel, while Dr. **Howard A. Rusk** will be Chairman of the panel on Rehabilitation and Physical Medicine.

Dr. **Michael M. Dacso**, New York, has been appointed to serve on the National Committee on the Aging and also on the Executive Planning Board of the Division of Welfare of the Aged, Welfare and Health Council of New York.

Scholarship

The National Society for Crippled Children and Adults and Kappa Delta Phi, professional education fraternity, have awarded a scholarship of $1,000 for graduate training at the School of Social Service Administration, University of Chicago. A qualified student desiring to specialize in the rehabilitation of the crippled will be eligible for the scholarship. Applicants must hold a bachelor's degree and have completed at least one year of professional education in an accredited school of social work. Additional information may be obtained from the National Society for Crippled Children and Adults, 11 S. La Salle St., Chicago 3, Ill.

University of Michigan Physical Therapy Program

Information has been received that the University of Michigan is planning a program in physical therapy, leading either to the degree of Bachelor of Science in Physical Therapy or a Certificate in Physical Therapy. The first class will be admitted in September, 1952. Write direct to the University for details.

Six Medical Schools Approve Resolution

Six medical schools of Pennsylvania have made favorable reply to a resolution approved by the House of Delegates of The Medical Society of the State of Pennsylvania recommending the establishment of departments of Physical Medicine and Rehabilitation at the undergraduate and graduate level.

The University of Pennsylvania, Temple University School of Medicine, Woman's Medical College of Pennsylvania, Jefferson Medical College, Hahnemann Medical College and the University of Pittsburgh School of Medicine have all agreed to review their curriculum and institute this subject in their schedules.

This is an important step forward in the recognition of Physical Medicine and Rehabilitation as a specialty since doctors themselves have recognized the great need for graduate and undergraduate instruction in Physical Medicine and Rehabilitation.

Dr. Albert A. Martucci, of Philadelphia, is chairman of the Commission of Physical Medicine and Rehabilitation, which presented the resolution before the House of Delegates. Drs. Guy H. McKinstry, of Washington, and Pascal F. Lucchesi, of Philadelphia, read the resolution into the records during the last annual session of The Medical Society of the State of Pennsylvania.

Section on Physical Medicine and Rehabilitation, A. M. A.

The following officers have been elected for the 1952-53 period: Chairman, Kristian G. Hansson, New York; Secretary, Walter J. Zeiter, Cleveland.

Adopt New Method of Artificial Respiration

The Surf Life Saving Association of Australia officially adopted the "push-pull" Holger Nielsen method of artificial respiration at its annual meeting in June. The report of the Council on Physical Medicine and Rehabilitation on the method assisted the association in arriving at its decision.

New Unit at University of Illinois

Construction has been started on a new classroom and laboratory building in the Medical Center District to permit the colleges of medicine, pharmacy, and dentistry to increase their enrollments.

(*Medical News Continued on Page 559*)

ARCHIVES of PHYSICAL MEDICINE
OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL MEDICINE

∴ EDITORIALS ∴

A NEW APPROACH TO AN OLD PROBLEM

The statement is often made that physical medicine is applied physiology. This, of course, is only partially true, since chemistry, physics, anatomy, and the other fundamental sciences each plays a role. Nevertheless, physiology is exceedingly important in physical medicine. This is well illustrated by Kabat's article in this isue of the ARCHIVES, one of a series on the general topic "Studies on Neuromuscular Dysfunction." [1] The title of the present paper is "The Role of Central Facilitation in Restoration of Motor Function in Paralysis."

The author first presents the physiological background laid by such men as Sherrington, Fulton, and Gellhorn as well as by himself. He then describes techniques for obtaining maximal excitation of anterior horn cells through central facilitation. This may be accomplished by (1) Maximal resistance. (2) Stretch, (3) Mass movement patterns, (4) Reflexes, and (5) Reversal of antagonists. These methods have been used successfully by Kabat and his associates at the Kabat-Kaiser Institute in various types of paralysis on a scale which leaves little doubt of their effectiveness.

The usual cautious use of passive motion, assistive motion, free motion with and without gravity eliminated, and, finally, resistive motion has been discarded by the author in the treatment of the paralyses. He starts with maximal resistance from the beginning. Instead of the painstaking reeducation of isolated muscles, he uses mass movement of whole muscle groups. Instead of concern about the danger of over-stretching paralyzed muscles, he purposely employs stretch as a therapeutic method. Instead of attempting to avoid fatigue, the author advocates giving the patient several hours of activity daily. This is indeed a radical departure from generally accepted procedure, yet when one follows the author's reasoning, it does not appear so.

Kabat makes use of certain reflexes to enhance the central facilitation effect, for example, the tonic neck reflex of Magnus, the postural reflexes, and the righting reflexes. The last device mentioned is the rapidly alternating contraction of antagonistic muscle groups. This may be accomplished by rhythmic stabilization, the rapid alternating isometric contraction of antagonists against resistance; by the isometric reversal of antagonists, by the isotonic reversal of antagonists with isometric contraction; or by the quick reversal of antagonists. These techniques aim to produce, by means of proprioceptive impulses, central facilitation of anterior horn cells and hence maximal stimulation of the involved muscles through their motor nerve supply.

The reader is advised to read this paper in detail as well as the rest of the author's contributions on this topic. They are stimulating and thought provoking.

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[1] Kabat, Herman: Studies on Neuromuscular Dysfunction, Arch. Phys. Med. 33:521.

STATE REGISTRATION OF PHYSICAL THERAPISTS

There appeared in the May, 1952, issue of the Physical Therapy Review[1] a resumé of the present status of the local registration of physical therapists by state examining and licensing bodies. At the present time 15 states and the Territory of Hawaii have enacted legislation pertaining to this matter. These are: Arizona, Connecticut, Florida, Georgia, Illinois, Maryland, Massachusetts, Minnesota, New Hampshire, New Mexico, New York, North Carolina, Pennsylvania, South Carolina, and the Territory of Hawaii. Similar legislation is under consideration in California, District of Columbia, Kentucky, New Jersey, Tennessee, and Wisconsin.

In the states of Arizona, Maryland, New Mexico, New York, and Pennsylvania practice of physical therapy without a state license is prohibited. In other states the use of the title Registered Physical Therapist, or any similar term, by those not registered is prohibited, although practice is not. It would appear at once that such legislation as this would not accomplish a great deal toward raising the standards of physical therapy practice. It is, however, probably the best that can be accomplished in situations where there is great opposition from irregular groups. It is likely to be a choice between such legislation and a law with a "grandfather clause" which blankets in everyone who has practiced any brand of physical therapy in the state for a year or more.

The method of licensing varies considerably in the different states. In some, graduates of schools approved by the Council on Medical Education and Hospitals of the American Medical Association are licensed without examination. In others, registrants of the American Registry of Physical Therapists, and/or members of the American Physical Therapy Association are also licensed without examination; and in still others all applicants must submit to examination. Most of the examinations are given under the direction of the State Board of Medical Examiners or some similar body assisted by qualified physical therapists. Examination fees vary from $5.00 in New Hampshire to $30.00 in New York. Annual fees vary from $1.00 to $5.00. Reciprocity is available in most states for fees ranging from $5.00 to $25.00.

Most of the licensing laws stipulate that the physical therapist must practice only on the prescription and under the direct supervision of doctors licensed to practice medicine and surgery. This is as it should be, since physical therapy is auxillary to medicine and surgery. Qualified physical therapists do not wish any other arrangement.

State licensing gives legal status to the practice of physical therapy, but it also adds another fee to the budget of the therapist. If the physical therapist belongs to the American Registry, and the American Physical Therapy Association and has to pay a state license fee, the annual expense approaches $20.00 to $25.00. Fortunately, most of the state fees are nominal, but some appear unreasonably high.

State licensing of physical therapists is spreading and seems to be here to stay. If it helps to raise and maintain high standards of practice in this field, it is commendable. If it simply legalizes practice by the incompetent and the inadequately trained, it is not commendable and will do positive harm. Up to the present time, laws enacted have, in general, been fairly satisfactory.

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[1] State Registration of Physical Therapists, Phys. Ther. Review, Vol. 32, pp. 256-161 (May) 1952.

Medical News

(*Continued from Page 556*)

Rehabilitation Film

The film "A New Beginning," presented by the U. S. Army with cooperation of the Institute of Physical Medicine and Rehabilitation may be purchased from the United World Films, Inc., 1445 Park Ave., New York 29, N. Y. It will prove of interest to any adult who is not familiar with the advantages of physical medicine and rehabilitation.

Film Strips Available

The following film strips may be obtained by writing to Filmstrips, Inc., 140 W. 86th St., New York, N. Y.: "Crutchwalking," "Use of the Wheelchair," "Bed Exercises," and "Mat Exercises."

The Institute of Physical Medicine and Rehabilitation, 400 E. 34th St., New York 16, N. Y., has available "She Can Do It Herself: Paraplegic Homemaking," and "She Can Do It Herself: Polio Homemaking."

Write to the above organizations for additional information.

Movie on Cerebral Palsy

Dr. George Deaver is Technical Adviser of a 16 mm., color, sound movie on Cerebral Palsy-Methods of Ambulation. It may be purchased from the New York State Association for Crippled Children, 257 Fourth St., New York, N. Y., or loaned from the National Society for Crippled Children and Adults, 11 S. La Salle St., Chicago 3, Ill.

Chicago Medical School Gift

The Chicago Medical School was recently presented with a check in the amount of $7,500 by the Faculty Wives' Association. The money will be used for scholarships and research.

Physical Therapy Manufacturers Association

The following officers were elected for the 1952-53 season: Chairman, Theodore T. Blumberg, M.D., Liebel-Flarsheim Co., Cincinnati, Ohio; Vice-Chairman, Oscar Dallons, Dallons Laboratories, Los Angeles, Calif.; Secretary, A. W. Anderson, Burdick Corporation, Milton, Wis., and Treasurer, A. L. Schwieckart, Hanovia Chemical and Mfg. Co., Newark, N. J.

Polio Grant

Washington University School of Medicine, St. Louis, Mo., was recently awarded a grant of $7,669 for continuation of the teaching and service programs of the division of physical medicine.

Recognition for Clinic

Laurel Hospital and Clinic at Laurel Run in Pennsylvania has been admitted to membership in the American Hospital Association, the Pennsylvania Hospital Association and has been approved by the American Medical Association. The institution was established last year by Dr. Nicholas Mauriello. In addition to being a member of the Congress, Dr. Mauriello is a member of the American Society of Physical Medicine and Rehabilitation and a diplomate of the American Board of Physical Medicine and Rehabilitation.

Daniel Institute, Inc.

Earle H. Daniel, a contributor to the ARCHIVES OF PHYSICAL MEDICINE, has recently opened the Daniel Institute of Prosthetics Service and Rehabilitation, 619-21 W. Broward Blvd., Fort Lauderdale, Fla. Dr. Harriett Gillette, a Congress member, is Chief Consultant of Physical Medicine. Among the activities are proper evaluation, prescription and fitting of devices, limbs, and gadgets to assist patients referred to the Institute in regaining the use of defective limbs and proper use of artificial limbs. For additional information, write direct to Mr. Daniel, Director.

Seminar in Physical Rehabilitation Methods for Nurses

The Institute of Physical Medicine and Rehabilitation, New York, N. Y., is offering a three-week seminar designed for registered nurses in hospitals as well as in the Public Health fields. Among the instructors are Doctors Howard A. Rusk, George G. Deaver, and Donald A. Covalt. Dates are Dec. 1-19, 1952; March 2-20, 1953, and May 18-June 5, 1953. Applications and requests for additional information should be directed to Miss Edith Buchwald, Director of Rehabilitation Courses for Physical Therapists, Institute of Physical Medicine and Rehabilitation, 400 E. 34th St., New York, N. Y.

Postgraduate Courses Offered in Physical Medicine and Rehabilitation

The following institutions are conducting postgraduate courses in physical medicine: College of Medical Evangelists, Oct. 1-Nov. 19; Office of the Surgeon General, Educational and Training Div., Washington, D. C., Oct. 1-3; Graduate School of Medicine, University of Pennsylvania, Sept. 29, 1952, to May 23, 1953, and June 16-27, 1953. Postgraduate courses in Physical Medicine and Rehabilitation are being offered by New York Polyclinic Medical School and Hospital, arranged, 4 weeks, part time, New York University Post-Graduate Medical School, 5 courses (write for details).

Accepted Apparatus

Batrow Neuromuscular Stimulator, Model B. — Manufactured by Batrow Laboratories, Inc., R. F. D. 1, Branford, Conn., device generates condenser discharges. It was found the instrument has merit in electrotherapy as a neuromuscular stimulator, but only for muscles possessing a normal nerve supply. No evidence was found that the device was useful for diagnostic purposes or for stimulation of paralyzed muscles. The Council on Physical Medicine and Rehabilitation voted to include the apparatus in its accepted list.

Newly Registered Therapists

July 16, 1952

Allott, Nancy Eleanor, 296 Grand St., Newburgh, N. Y.

Alvord, Lucille Eileen, 55 Herrick Rd., Newton Centre 59, Mass.

Austin, Mary Ann, 114 Observatory St., Bennington, Vt.

Barclay, Claire Jean, 60 Berkeley St., Barre, Vt.

Becker, Barbara Violet, R. R. No. 2, Box 118, Barrington, Ill.

Bonisteel, Marian Elizabeth, 565 Cumberland Ave., Syracuse, N. Y.

Chadwick, Norma Rice, 7 Garfield Ave., Hamden, Conn.

Cody, Anne, Canton Ave., Milton, Mass.

Craig, Charlotte D'Artenay, 700 Gordon, Reno, Nev.

Dias, Carol Mary, 42 Amory St., Cambridge, Mass.

Ferron, June Frances, 1105 N. E. 117th St., Miami, Fla.

Greene, Norman Charles, 314 N. Blue, Walla Walla, Wash.

Griswold, Joan McLane, Box 85, The Willows, Old Lyme, Conn.

Hahn, Maurice Griffith, 301 Thomas Apts., Minot, N. Dak.

Herwig, Gordon Evans, 1908 State St., Santa Barbara, Calif.

Hirsh, Nancy Lee, 720 Ft. Washington Ave., New York 33, N. Y.

Hofmann, Warren Henry, 1466 Bellevue Ave., Burlingame, Calif.

Hubbuch, Margaret Caroline, 574 S. Crest Rd., Chattanooga 4, Pa.

Kaiser, Barbara Marie, 39 Munsel Dr., Cranford, N. J.

Lewis, Joanne, 640 Beverly Rd., Mt. Lebanon, Pittsburgh 16, Pa.

Lueke, Dorothy Ellen, 1620 N. 52nd St., Seattle, Wash.

McFarlane, Margaret, Rt. No. 2, Box 337, Tigard, Ore.

Moore, Mary Ellen, 14 Green Hill Rd., North Haven, Conn.

Muratore, Rose M., 88 Columbia St., Meriden, Conn.

Murphy, M. Jean, 65 Bird St., Dorchester 25, Mass.

Nelson, Harriette Elaine, 1519 Del Rosa Ave., San Bernardino, Calif.

Quinn, Joan Frances, 57 Linden St., Fall River, Mass.

Rathjen, Edward Jerome, 1430 Yosemite St., San Jose, Calif.

Richardson, Carol Ann, 4700 Alpine Rd., Redwood City, Calif.

Saunders, Roy Holman, 718 S. Sherman St., Denver, Colo.

Scott, Ralph Allen, 33 E. High St., Plymouth, Ohio.

Seely, Susanne Warner, 2171 Middlefield Rd., Cleveland Heights, 6, Ohio.

Shelton, Kenneth, 1301 Waldrip St., Elma, Wash.

Smolak, Anna Jane, 40 W. Spring St., Somerville, New Jersey.

Stearns, Barbara Jean, 198 Maplewood St., Watertown 72, Wash.

Wilcox, Lois Irene, 50 W. Blackwell St., Dover, N. J.

July 23, 1952

Campbell, Donald S., 5541 36th Ave., S., Minneapolis, Minn.

Dahlgren, Dean R., 2165-H Hoyt Ave., W., St. Paul, Minn.

Gostick, Glenn F., 422 Russell Ave., N., Minneapolis, Minn

Grabner, Mary J., 630 S. E. 7th St., Minneapolis 14, Minn.

Kasinkus, William, 310 12th Ave., S. E., Minneapolis 14, Minn.

Klein, Frank J., 301 Wildwood Ave., Birchwood, White Bear Lake 10, Minn.

Kleinschmidt, Joan, 1026 Carney Ave., Mankato, Minn.

Lindquist, Wernette B., 3241 Twin Lake Rd., St. Paul 6, Minn.

McQuillan, Patricia A., Rt. 9, White Bear Branch, St. Paul 10, Minn.

Moen, Wilbur L., Box 71, Upham, North Dakota.

Mundale, Martin O., 689 22nd Ave., N. E., Minneapolis, Minn.

Pohtilla, James F., 3525 3rd Ave., W., Hibbing, Minn.

Powell, Nadine, 200 12th Ave., S. E., Minneapolis, Minn.

Wessels, Geraldine G., Raymond, Minn.

Westrem, Douglas J., 35½ Luverne S., Minneapolis 19, Minn.

Wuolet, Margaret J., 2118 Glenwood, Minneapolis 5, Minn.

BOOK REVIEWS

The reviews here published have been prepared by competent authorities and do not necessarily represent the opinions of the American Congress of Physical Medicine.

ULTRAVIOLET RADIATION. By *Lewis R. Koller*, Ph.D., Research Associate, General Electric Research Laboratory, Schenectady, New York. Cloth. Price, $6.50. Pp. 270 with illustrations. John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, 1952.

The voluminous writings on the subject of ultraviolet radiation present a formidable task to any physician who would attempt to master the subject. However, this book presents the basic concepts of the subject, particularly in terms of the physical principles involved, in such a straight forward and clearly understandable manner as to bring an understanding of the basic physics of ultraviolet generators within the ability of the physician or other person with a serious interest in the subject.

The text is divided into eight chapters as follows: Introduction, Arcs, Incandescent Sources of Radiation, Solar Radiation, Transmission, Reflection, Some Applications and Effects of Ultraviolet, and Detectors of Ultraviolet Radiation. The illustrations, charts, tables, and graphs contribute enormously to the book's lucidity.

The author, fortunately, makes a minimal attempt to present the more controversial aspects of the medical application of ultraviolet energy. This book will be of interest to anyone concerned with the subject of ultraviolet radiation and will be of special value to all physiatrists.

MENDERS OF THE MAIMED. THE ANATOMICAL AND PHYSIOLOGICAL PRINCIPLES UNDERLYING THE TREATMENT OF INJURIES TO MUSCLES, NERVES, BONES AND JOINTS. By *Sir Arthur Keith*, M.D. (Abdn.), F.R.C.S. (Eng.), LL.D. (Abdn.), F.R.S. Conservator of the Museum and Hunterian Professor, Royal College of Surgeons, England. Cloth. Price, $10.00. Pp. 335 with illustrations. J. B. Lippincott Co., East Washington Square, Philadelphia, Pa., 1952.

Here is a book that is a rare treat. Although written by an orthopedist and about the early orthopedists, particularly the English and French, it should be of greater appeal to physiatrists. Most of the book is concerned with the development and the use by these early orthopedists of rest, motion, massage, exercise, heat, cold, electricity and other measures now employed routinely in physical medicine.

It is fascinating and instructive to read about the discussions and opinions of these men who advocated physical measures many years ago. The great John Hunter showed profound respect for muscles — "He knew that a voluntary muscle was the most educable of all structures. By a repeated and judicious exercise of his will a patient may do more to help the recovery of muscular function than can be accomplished by the most complicated of gymnastic machines and of electric batteries." A lady who had lost the motion of her knee due to a fracture when advised to move the joint actively and concentrate on its movement secured good function, for he believed "if the influence of the mind were freely exerted on the muscle, it would gain this power of contraction," an idea that was thought to be original only a few years ago. Jean Pierre David also appreciated the purpose of active motion and the following quotation from his work, although made in the eighteenth century, is wisely followed today — "the machinery which can set the muscles to work lies in the patient's own nervous system. The only agency which can set the machinery in motion is the patient's own will. The sooner the patient ceases to rely on outside help, and the sooner he comes to realize the progress depends on his own efforts, the quicker and better will be the ultimate result."

An interesting chapter on "Movement as a Means of Treatment" considers the orthopedists in France, which the author describes as the cradle of orthopedic surgery, beginning with Nicholas Andry who published his work "Orthopedia" (a term which he coined), in 1741, continuing with such notable orthopedists as Delpech, Bonnet and others, and closing with the accomplishments of Lucas-Championniere who wrote the treatise on "Treatment of Fractures by Massage and Mobilization." This latter's well known quotation is as follows — "Massage allayed almost instantly the pain at the site of fracture; it accelerated the process of repair; it dissipated inflammation exudates, reducing swelling and tension in the damaged parts; it maintained muscles, nerves, tendons, ligaments, and joints in a state of health." An opinion that might be reviewed today since the therapeutic value of massage is being questioned.

The chapter about Duchenne of Boulogne is chiefly concerned with his contributions in the use of the faradic current for the treatment of chronic joint and muscular conditions and for its diagnostic purposes. The story is told of his difficulties with the physicians in Paris with his induction coil; fortunately by his patience and perseverance, and perhaps his personality described a "Don Quixote and Sancho Panza rolled into one," he was able eventually "to open the door to a new field of knowledge."

A most interesting chapter is entitled "The Introduction of Gymnastics and Massage to Surgery" which relates the influence of Jacques Delpech and his Gymnastic Institution which he established in Montpellier in 1825, John Shaw and the Windmill Street School in London, and last but not least the "medical gymnastics" of Pehr Henrik Ling of Sweden.

These are merely a few examples of the contributions by orthopedists and others in advancing the field of physical medicine — numerous others might be included.

The following words on the fly leaf are worthy of quoting — "Every once in a while there comes along a project which makes the publisher feel that he is really contributing something through his chosen vocation. The opportunity to make available a classic work such as 'Keith's Menders of the Maimed' is something which brings pleasure and inspiration to publishing. It is a monumental piece of writing which surely reflects that rare combination of head, heart and hand. The book is for the few rather than for the many."

Only 1500 copies of this edition have been printed and are marked for distribution in the United States. It should be in the library of every physiatrist.

PHYSICAL REHABILITATION FOR DAILY LIVING. By *Edith Buchwald,* M.A., A.R.P.T., Director of Rehabilitation Courses for Physical Therapists, Institute of Physical Medicine and Rehabilitation, New York University-Bellevue Medical Center. In collaboration with *Howard A. Rusk,* M.D., Professor and Chairman, Department of Physical Medicine and Rehabilitation; *George G. Deaver,* M.D., Professor of Clinical Physical Medicine and Rehabilitation; *Donald A. Covalt,* M.D., Associate Professor, Physical Medicine and Rehabilitation, New York University-Bellevue Medical Center. Cloth. Price, $7.50. Pp. 183, with illustrations. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York, 1952.

A good sign of progress in the field of Physical Medicine and Rehabilitation is the appearance of new and excellent textbooks. In the past, knowledge about the techniques of teaching paraplegics how to develop independence in the acts of daily living, including dressing, toilet care, ambulation, and use of a wheelchair, could be gained only by training experience in the very limited number of centers doing this work. Now this splendid book makes it possible to give our student therapists a proper text from which to learn the basic techniques before their clinical practice, and it will also serve as a valuable reference during actual application. Because of its excellent and profuse photographic illustrations, it can be used by the neophyte therapist as a daily guide in planning a physical rehabilitation program for a patient much as the surgeon may study anatomical charts before the forthcoming operation. It should also be of benefit to the patients themselves, particularly if they do not have the opportunity to observe other more advanced patients in the treatment center.

The book is primarily devoted to the problem of the paraplegic and shows step by step his progress in developing skill in independent living, starting in bed, and continuing on the mat, in the wheelchair, on crutches, and on public transportation. This is done largely by photographs, but appropriate directions and precautions are outlined. Charts to measure progress are included, also chapters on apparatus. As the title indicates, only physical rehabilitation techniques are presented, not the general medical, psychological, social and economic problems of the paraplegics.

The book should be a required reference text for all physical therapy students, and should be in all physical medicine and rehabilitation libraries.

THE HOSPITAL PURCHASING FILE 1952. Twenty-ninth edition. Cloth. Price, $3.00. The Modern Hospital, 919 N. Michigan, Chicago 11, 1951.

This volume, like previous editions, is a ready reference for hospital purchasing agents and administrators of the sources of supplies. Last year's innovation, a check list and description of equipment for a new general hospital is continued; it will interest those responsible for established institutions as well as those contemplating new ones.

Specialized therapeutic, diagnostic and laboratory equipment, although an integral part of a modern hospital, is only cursorily covered, in part because the coverage reflects the advertisers in "Modern Hospital." In view of the imposing weight of the volume, perhaps the publishers might consider the advisability of establishing a supplement concerned with such items.

INTERNAL MEDICINE: ITS THEORY AND PRACTICE. By *John H. Musser,* B.S., M.D., F.A.C.P., Late Professor of Medicine in the Tulane University of Louisiana School of Medicine, New Orleans, La., and *Michael G. Wohl,* M.D., F.A.C.P., Assoc. Professor of Medicine, Temple University School of Medicine, Chief of Nutrition Clinic, Philadelphia General Hospital, Chief of Endocrine Clinic, Temple University Hospital. 80 Contributors. Fifth edition. Cloth. Price, $15.00. Pp 1563 with 236 illustrations and 10 plates in color. Lea & Febiger, 600 S. Washington Sq., Philadelphia 6, 1951.

This text book, in general, is skillfully prepared and contains a vast amount of medical information, which is easily read and understandable. Many of the more recent advances in medicine have been included. The sections pertaining to geriatrics, medical genetics and psychosomatic medicine are welcome additions to a general medical text.

The sections pertaining to infectious, endocrine, cardiovascular, renal, locomotor, and nervous diseases are especially well-written by authorities well-known in their respective fields. A chapter on the principles of anti-microbial therapy deserves special mention. It is brief, concise, and clarifies the indication for various antibiotics and the basic mechanisms regarding their respective mode of action.

Illustrations, including both black and white and color photographs are adequate, except in the section pertaining to blood diseases, which could be improved with color photographs of blood dyscrasias.

The bibliographies contain numerous well-chosen articles, including many from the recent medical literature.

This book appears to be complete in most respects and therefore can be recommended as excellent basic text in general medicine.

THIS WILL KILL YOU. By *Charles Furcolowe.* Cloth. Price, $2.75. Pp. 190, with illustrations. B. C. Forbes & Sons Publishing Company, Inc., 80 Fifth Ave., New York, 1952.

This humorous book written by Charles Furcolowe is a pseudo-scientific volume in which he presents serious health hints in a comical fashion. The book was written under the critical supervision of a distinguished physician and the material is based on vital statistics and case histories.

The author satirizes in a humorous fashion the many habits of modern business men that lead him to an early grave. He discusses such interesting subjects as "How's Your Blood Pressure," "You, Too, Can Have an Ulcer," "The Smoke Eaters," "Exercise Is for Horses" and many other equally intriguing subjects in which facts are often exaggerated in order to emphasize the underlying advice. There are many humorous items and good laughs in this book and in many instances he startlingly depicts the many things we do in our daily lives that we know are or could be detrimental to our health.

DER ULTRASCHALL IN DER MEDICINE (Ultrasound in Medicine). Reports of the Erlangen Congress on Ultrasonics of 1949, and Transactions of Its Scientific Sessions. Volume I. Edited by *Prof. Dr. K. Matthes,* Director of the University Medical Clinic, Erlangen, and *Prof. Dr. W. Rech,* Asst. Director of the University Medical Clinic, Erlangen, with assistance of *Dr. Wachsmann, Dr. Barth* and *Dr. Schoenefeldt.* Paper. Price, $7.25. Pp. 472, with 146 illustrations and 50 tables, 1949. Volume II. Progress in Biologic and Medical Research Contributed by the 1950 Ultrasonic Congress at Rome. Edited by *Kh. Woeber,* M.D., Bonn. With co-workers *O. Hug,* M.D., Frankfurt; *Dozent W. K. Keidel,* M.D., Erlangen, *H. Ladeburg,* M.D., Freiburg; *J. Lehmann,* M.D., Frankfurt; *R. Pohlman,* Ph.D., Zurich; *Prof. Dr. G. Schmidt,* Stuttgart; *F. Schwab,* M.D., Vienna; *K. Stuhlfauth,* M.D., Munich; *G. Veltman,* M.D., Bonn; *L. Wyt,* Vienna. Paper. Price, $1.20. Pp. 80, 1950. Volume III. Contributions to the Problem of Dosage Measurement and Dosage Techniques in Ultrasonic Therapy. Released in Association with the Society of Ultrasonic Research. Edited by *Karlheinz Woeber,* M.D., Bonn, in cooperation with 15 co-workers named in text. Paper. Price, $1.32. Pp. 90, with 27 illustrations and 3 tables, 1951. Published in association with the Society for the Study of Ultrasonics. S. Hirzel Verlag, Stuttgart.

These three volumes earnestly call our belated attention to a new therapeutic agent described as ultrasonics which promises to exert as prominent an influence in medicine as it has in the spheres of biology, chemistry and industrial pursuits. It claims our special interest through the eloquence of an exhaustive experience initiated by Pierre Curie in 1880, on a source of energy whose nature and characteristic were subsequently determined by reputable international workers to give us an orientation in the best tradition of modern research. The books represent the collective opinion of many hundred contributors and is supported by more than a thousand references in order to add to the validity of conclusions expressed in the recent Congress on ultrasonics at Erlangen and Rome by a representative body of organized physicians and scientists gathered to evaluate the mass of current experiences related to this field of practice. Of the 73 papers included in the first volume, each has its claim to distinction both by name of author and/or the distinguished association with a university background of historic tradition. Thus, whatever the subject or conclusion contributed it has as a basis for its acceptance the hall-mark of authority, giving this, the youngest of our healing methods, a hearing in equally representative circles in other lands.

The first of these monographs is as rich a source of original and confirmative information which virtually covers every essential facet of the physical and biochemical action of ultrasonics, its clinical applicabilities, techniques, and indication in medical practice. In content the text is supported by authorities whose names are widely quoted wherever ultrasonics is the topic of discussion, such as Schliephake the earliest of German pioneers, as well as Pohlman, Dussik, Buchtala, Hintzelman, Stuhlfauth, Barth, Demmel, Denier, Wachsmann, to mention a few who virtually represent the authoritative opinion on the subject. Throughout, the exposition is highly supported by quantitative proof in addition to illustrations and tabulated data, a rich bibliography and index. Its major limitation is purely of a linguistic nature which unfortunately is a handicap to the many to whom its reading would be a welcome education as an introduction to ultrasonics in medicine.

Volumes II and III are small monographs dealing with the advances of biochemistry applied to medicine through ultrasonics as presented at the International Ultrasonic Congress in 1950, at Rome, and with the problem of dosage control and its application to ultrasonic therapy, both under the editorship of Dr. Karlheinz Woeber, and a long list of authoritative co-workers mentioned in the text. In each there is a quality of timeliness and substance that recommends itself to both student and practitioner for its promising orientation on essential fundamentals associated with the use and interpretation of ultrasonics in medicine. Volume II is actually the summing up of 33 papers within the scope of 15 chapters in concise but comprehensive form, in order to present at the earliest period its important data to the widest circle of interested readers. Its merit is demonstrated by its increasing popularity abroad, for it not only reduces the tedious wait for published articles in scattered journals but has the virtue of offering the sectional transaction within the pages of a single volume. Each chapter under the pen of a recognized authority therefore offers in compact form an amazing amount of information. To mention a few, Pohlman reviews the question of the radiation effect of the ultrasonic field in relation to dosages. Justus Lehmann recently of the University of Frankfurt and now of the Mayo Clinic, contributes three chapters (1) on the recent advances of the fundamental biophysical effects of ultrasonic therapy, (2) on the effect of ultrasonics on the formative elements of the blood, and (3) on the nature and effect of impulse sounding in ultrasonic therapy. Lehmann, in his studies, rightly insists that the thermic factor is a role not to be denied, but others with equal authority insist that ultrasonic energy is not diathermy but an energy which releases physical and thermo-dynamic forces of an identity independent of heat alone. The 678 references up to January, 1950, of the progress of ultrasonics in physics, biology and medicine is a tribute to the scholarly cooperation of Professor L. Bergmann and recalls his own text of over 1100 pages as the classic in its field.

Volume III deals with the many problems of dosage measurement and its techniques and has become one of the most sought after texts on the practical and theoretic understanding of this important facet of ultrasonic therapy. . It virtually reviews all the techniques and variable approaches as part of the dosage problem in therapy. In its fifteen chapters it brings the importance of the subject into clear focus by many original expositions by a selected group of representative authors. Indeed it is difficult to conceive how one could enter this field of ultrasonic therapy without the clear orientation this small monograph offers through the guidance and opinions of such reputable names as Waldick, Keller, Barth, J. Lehmann, Buchtala, Wegner, Koeppen and others. The text is in the best tradition of German workmanship, including a representative bibliography. These three monographs convey an illuminating impression of the present status of ultrasonic therapy through an authoritative evaluation of its highly promising future in the field of medicine.

MASS CARE IN DISASTER. ARC 1540. Paper. Pp. 107, with illustrations. American National Red Cross, 17th and D St., N. W., Washington, D. C., 1951.

This booklet contains an extraordinary amount of detailed information for use by those who undertake to give organized assistance to victims of disaster. The instructive opening section describes the complexities of the necessary organization, including the relation of other agencies to the local chapters. This is followed by a section confusingly headed "The Chapters," namely, chapters on food, on clothing, on shelters, on medical and nursing services, and on civil defense. These chapters contain valuable check-lists of supplies that may be needed and duties to be performed, and they are supplemented by extensive appendixes dealing mainly with problems of mass feeding. Appendixes E (Food Purchase Guide) and I (Suggested Recipes for Mass Feeding) are especially good. Rather hard to decipher is Appendix P, which features three baffling sketches, abbreviates unfamiliar words that ought by all means to be spelled out, and uses the deprecated symbol # in three different senses. Appendix S is a "disaster application·card" the significance of which is not immediately clear. These points are mentioned because clarity seems especially desirable in books to be consulted in emergencies. As a whole, this booklet deserves high praise for the constructive, humanitarian effort it represents. A wide reading would bring to many people a better understanding of this aspect of the work of the Red Cross.

RECENT ADVANCES IN MEDICINE. By *G. E. Beaumont,* M.A., D.M. (Oxon.), F.R.C.P., D.P.H. (Lond.), Physician to the Middlesex Hospital; Physician to the Hospital for Consumption and Diseases of the Chest, Brompton; Lecturer in Medicine, Middlesex Hospital Medical School; and *E. C. Dodds,* M.V.O., D.Sc., Ph.D., M.D., F.R.C.P., F.R.I.C., F.R.S. (Edin.), F.R.S., Professor of Biochemistry in the University of London; Director of Cautauld Institute of Biochemistry, Middlesex Hospital. Twelfth Edition. Cloth. Price, $6.00. Pp. 422, with 42 illustrations. The Blakiston Company, 1012 Walnut Street, Philadelphia 5, 1947.

This book, Recent Advances in Medicine, was compiled by the authors, first, to assist physicians who have lacked the opportunity for graduate study, to familiarize themselves with some of the notable advances in medicine; second, to provide a reference book for those preparing for the specialty boards, and third, to include recent chemical methods so as to be of assistance to the laboratory worker, thus forming a link between the hospital wards and the laboratory. Naturally, it is most difficult to decide the actual scope of the contents, but the authors have apparently used unusual talent and discretion. This is the twelfth edition of the work, which would seem to indicate its usefulness.

This edition has been thoroughly revised and about one hundred pages of new material added. In chapter one, entitled chemotherapy, the mode of action of the sulfonamide drugs has been rewritten and a new section added on synthetic anti-malarial drugs. The penicillin chapter is new and is discussed both from the laboratory and the clinical aspects; in addition an article on streptomycin, streptothricin, and tyrothricin is also added. Marked alterations have been made in the chapter on vitamins. New articles appearing include those dealing with thiouracil, primary atypical pneumonia, infective hepatitis, homologous serum jaundice, bone marrow transfusion, and the use of thiocyanates in the treatment of high blood pressure. The work is divided into fourteen chapters. Each chapter closes with a well chosen list of references. The book is well written and well illustrated.

NEW CONCEPTS OF HYPNOSIS AS AN ADJUNCT TO PSYCHOTHERAPY AND MEDICINE.

By *Bernard C. Gindes,* M.D. Introduction by *Dr. Robert M. Lindner.* Cloth. Price, $4.00. Pp. 262. Julian Press, Inc., division of Julian Messner, Inc., 8 W. 400th St., New York 18, 1951.

This attractively bound and unctuously written book promises more than one new idea about hypnotism. Most of the material in it, however, is a repetition of old and equivocal concepts, and some of it will mislead readers who are not accustomed to making fine distinctions. On page 187, for instance, is a mention of "newer therapeutic methods," consisting of Medium Sleep, vibratory passes, and touchings of the eyelids, used to relax the eye-muscles and improve eye-sight; these are said to be good for "ocular difficulties" but not for "ocular involvement."

A complete review is said to include some statement as to the qualification of the author. On this point it can only be remarked that the title-page does not indicate either the institutional connections or the present whereabouts of the author, and that there is doubt as to the source from which he may have obtained the title of "M.D." claimed for him on both dust-cover and title-page.

This book is not recommended.

THE NEW WAY TO BETTER HEARING RE-EDUCATION.

By *Victor L. Browd,* M.D. Cloth. Price, $3.00. Crown Publishers, Dept. H-K, 419 4th Ave., New York 6, 1951.

This volume is prepared by a physician who has had experience in the rehabilitation of the hard of hearing. The important contribution offered in the book is on instructions for making audiometric examinations.

The author believes that his method of hearing reeducation, involving no surgery, hearing aids, drugs or medications, is a step forward. He claims that only a few minutes each day at home are required. In his opinion the method is for all people with defective hearing, whether or not they wear hearing aids. The author gives examples of methods by which the hearing can be improved, especially from the standpoint of intelligibility. Practice sessions are described. He uses a large number of practice words and sentences, exercises for "the freeing and converting of hidden hearing power," by "five private lessons per week" and "continuous reeducation throughout the day." He attempts to train the hard of hearing to be more attentive. Some case histories are mentioned to substantiate the value of his method of treatment.

It is doubtful that specialists in the field of audiology will agree with the author's explanation of how we hear. The author writes that the middle ear is like an amplifying instrument which "increases the force of strong sound waves as well as that of faint ones." The author's analogies occasionally lead him astray, as for example: "The middle ear apparatus is hooked into the inner ear in much the same fashion that a second locomotive is hooked onto a train, and for much the same purpose — greater power." The middle ear is claimed to be "nothing more than an amplifier." It picks up sound waves, increases their intensity, and delivers them to the oval window. Since there are already several theories of the process by which the human ear hears, and they do not agree among themselves, there is probably no objection to the presentation of another one. There are charts, graphs and other instructive material presented for assisting teachers to give instruction to the hard of hearing.

Parts of the volume are highly instructive, but some of the author's technical explanations are to say the least, unusual.

THE DISABLED IN THE MODERN WORLD.

PROCEEDINGS OF THE FIFTH WORLD CONGRESS OF THE INTERNATIONAL SOCIETY FOR THE WELFARE OF CRIPPLES HELD AT STOCKHOLM, SEPTEMBER 9-14, 1951 WITH THE CO-OPERATION OF THE SWEDISH CENTRAL COMMITTEE FOR THE CARE OF CRIPPLES. Clothbound, $3.50. Paperbound, $3 00. Pp. 279. International Society for the Welfare of Cripples, 127 East 52nd Street, *New York 22, 1951.*

The published proceedings of the Fifth World Congress since 1924 bring together the thinking of outstanding individuals of the world on the subject we loosely call medical rehabilitation. The subject matter discussed includes essentially all the major pathological conditions leading to physical handicaps. The various conditions are also considered from the point of view of the physician and surgeon, physical and occupational therapist, social worker, vocational tester and counsellor, and industrial employer.

This compilation should be available to all interested in the problem of planning and providing better facilities to care for individuals needing medical rehabilitation. Although technical details of therapy are not entirely lacking, those in the top level of planning and administration will find this of more value than will the therapist dealing with an individual patient.

POST-GRADUATE LECTURES ON ORTHOPEDIC DIAGNOSIS AND INDICATIONS.

By *Arthur Steindler,* M.D., F.A.C.S., Professor of Orthopedic Surgery, State University of Iowa, Iowa City, Iowa. Volume III. Cloth. Price, $8.75. Pp. 284, with illustrations. Charles C Thomas, Publisher, 301-327 East Lawrence Ave., Springfield, *Ill., 1952.*

Doctor Steindler of the University of Iowa is not only a great orthopedic surgeon but also an unusual teacher; therefore, it is always a great privilege to receive writings dictated from his many years of rich experience both in the clinic and on the lecture platform.

This is the third volume of postgraduate lectures on orthopedic diagnosis and indications. It is a worthy successor to the former volumes and should find just as warm a welcome. The book is divided into two sections: Section A deals with the subject of tuberculosis of the skeletal system; section B is concerned with the subject of osteomyelitis. In section A there are six lectures as follows: Lecture one on tuberculosis of the skeletal system: general; lecture two on tuberculosis of the spine (Pott's disease — spondylitis tuberculosa); lecture three on tuberculosis of the hip joints; lecture four on tuberculosis of the knee; lecture five on tuberculosis of the foot and ankle; and lecture six on tuberculosis of the upper extremity. In section B there are also six lectures: Lecture one on the pathogenesis and pathology of osteomyelitis; lecture two on the clinical pathology of osteomyelitis; lecture three on the treatment of osteomyelitis — acute and chronic; lecture four on osteomyelitis of the spine; lecture five on osteomyelitis of the pelvis; and lecture six on the more unusual types of osteomyelitis such as typhoid osteomyelitis, malta fever osteomyelitis, salmonella osteomyelitis, smallpox osteomyelitis, echinococcus infection of bone and the maduromycosis of bone.

These postgraduate lectures are all well planned, comprehensive, logically presented and written in easy understandable English. The lectures mostly follow a general plan of subdivision which is most helpful. Photographic illustrations have been amply supplied. The majority of the lectures culminate with an excellent summary of the subject matter. A reference list closes each lecture. In addition there is an adequate subject and author index.

The author does not discuss the role of physical therapy treatment. However, under the heading of constitutional therapy he gives ample attention to diet, vitamins, climatotherapy, and heliotherapy. He warns, however, that heliotherapy while of undoubted value must not be relied upon alone or considered adequate to cure surgical tuberculosis. Dr. Steindler states that it is necessary to warn against the indiscriminate and injudicious practice of heliotherapy in these patients. In some patients it is definitely contraindicated according to the author. Steindler has preference for the Rollier technique of exposure. It would seem unfortunate that the writer gives no consideration to artificial sources. Therapeutic sunlight in certain sections of the United States is so erratic both in quantity and quality of radiation. Physiatrists will find this volume most useful inasmuch as Steindler very carefully states just when and under what conditions weight bearing should be started. Hyperpyrexia is also mentioned as one form of treatment for osteomyelitis brucellosis.

This book must also be a matter of great pride to Charles C Thomas the publisher for it is a splendid tribute to his art. Both publisher and author are to be congratulated. The book is highly recommended.

ESSENTIALS OF HISTOLOGY. By *Margaret M Hoskins,* Ph.D., and *Gerritt Bevelander,* Ph.D., New York University. Second edition. Cloth. Price, $4.00. Pp. 240, with 135 text illustrations and 2 color plates. The C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, 1952.

This compact book will appeal to many students, and will probably serve their needs if they have a good teacher and laboratory facilities. The small size is achieved by the omission of much material of an introductory, fundamental, historical and controversial nature, as well as details of laboratory procedure. What is retained will be regarded by many students gratefully as the irreducible minimum of technical information, especially convenient for reviewing. This information is simply and accurately set forth.

The book does not, however, represent a substantial advance either scientifically or pedagogically over what was current twenty-five years ago. There is little reference to the remarkable developments of recent years, such as the results of phase microscopy, microincineration and radioautography. The illustrations are generally labeled with abbreviations which the student is to decipher by referring to the fine print of the legends. The eye-strain and annoyance is increased by the fact that sometimes (e. g., page 166) these abbreviations are not in any discernible order. Eponymic phrases like "Bowman's capsule" are still in evidence, and the stupid nomenclature of hematology is where it was a quarter of a century ago. The discussion about the monophyletic theory which bored medical students at that time continues (page 80) to occupy hematologists.

The book is attractively printed and bound, and though it lacks a bibliography it has a good index.

TEXT-BOOK OF ORTHOPAEDIC MEDICINE. Volume II. Treatment by Manipulation and Deep Massage. By *James Cyriax,* M.D., B.Ch. (Cantab.), Physician to the Department of Physical Medicine, St. Thomas Hospital, London. Cloth. Price, $6.00. Pp. 335, with illustrations. Fourth edition. Paul B. Hoeber, Inc., Medical Book Dept. of Harper & Brothers, 49 East 33rd Street, New York 16, 1951.

The author explains that this new fourth edition of this title is an amplification of previous editions and forms Volume II of a new work to be entitled "A Text-Book of Orthopedic Medicine." This present book is directed to the physical therapist to explain the technical aspects of massage and manipulation or passive exercise.

The text is well illustrated, particularly showing points for specific finger pressure in a variety of connective tissue disorders where the therapists may be asked to apply massage. There is a brief summary of indications, warnings, and other details of technique on the page facing each illustration. Statements are all quite positive and might be confusing to students in American schools less subject to didactic statements as to the indications and benefits of massage. The technical information as to details of massage for the conditions described is valuable and not available elsewhere. All instructors of physical therapists should welcome this as source material and as a reference text for students.

The physiatrist should also consider this an essential part of his library. Some of the illustrative material indicates that the physician himself gives the treatment, in particular, the traction and manipulations; in this country we would recommend that this be merely the accepted practice.

As a physician, one may question some of the indications for therapy described, but, since the book is directed toward therapists, no detailed discussion of indication of prescription or differential diagnosis is necessary, and this criticism may be avoided.

The section on varicose ulcers seems misplaced and unnecessary.

The publishers are to be congratulated on the excellence of this work.

A TRANSLATION OF GALEN'S HYGIENE (De Sanitate Tuenda). By *Robert Montraville Green,* M.D., Emeritus Professor of Anatomy, Harvard Medical School, Boston, Massachusetts. With an Introduction by *Henry E. Sigerist,* M.D. Fabrikoid. Price, $5.75. Pp. 277. Charles C Thomas, Publisher, 301-327 East Lawrence Avenue, Springfield, Ill., 1951.

This is the first translation of Galen's De Sanitate Tuenda into any modern language. Few of Galen's works are available in modern translations. This present translation was undertaken at the suggestion of Dr. Sidney Licht, and was made primarily from Kuhn's edition of the Greek text.

In the light of subsequently acquired knowledge much that Galen wrote is inaccurate. Yet his thinking was fundamentally sound. Some of his ideas are positively modern and show startling anticipation of future discovery. Galen was a very able physician who has a great deal to say and he had a keen understanding of the patient's psychology.

Galen was a great admirer of Hippocrates and from him borrowed the concept of the four cardinal humors that constitute the human body, blood, phlegm, yellow bile and black bile, and also the concept of elementary qualities, hot, cold, dry, moist, which occur in the body in a number of combinations and degrees. Galen shows that the hygienist's goal is to maintain the normal equilibrium of humors and qualities by prescribing the correct kind and amount of food, drink, sleep, wakefulness, sex activity, exercise, massage, and similar matters. It is startling to find how well he appreciated the variations of the norm in different individuals. Here, his concept is quite modern.

Galen also realized that not only health educators but that gymnast and masseur played an important part in the practice of hygiene. He states that while the trainer knows all the movements made in the gymnasium, he is ignorant of what each movement can accomplish, but the gymnast will not be ignorant of its effect. To over exercise, as some trainers compel boys to do, is not good, for he states that growth of the body may thus be prevented, even if it has the usual interval impulse for growth.

The history of medicine rarely, if ever, finds a place in medical education and this is most unfortunate. We can learn much from the past; thus everyone in the field of medicine owes a great debt to Doctor Green for this excellent translation of Galen's De Sanitate Tuenda. Gratitude of the medical profession should also be extended to the Julia Lecht Fund, which commissioned the translation. Charles C Thomas, as usual, has presented a work worthy of the publishing art.

This is a fascinating work and should be in the library of every physician. No physiatrist can afford to be without this classic. This is the kind of book which, once reading is started, one finds it difficult to lay aside.

Dr. Henry Sigerist formerly of Johns Hopkins University writes a splendid introduction and Dr. Sidney Licht gives an unusually fine translation from Daniel Le Clerc's Histoire de la Medicine on the life of Claudius Galen. This book is highly recommended.

THE HENRY L. JAFFE ANNIVERSARY NUMBER OF THE BULLETIN OF THE HOSPITAL FOR JOINT DISEASE. By *Samuel Kleinberg,* M.D., Editor-in-Chief, with 55 contributors of 35 original articles. Vol. 12, No. 2, October, 1951. Paper. Price, $6.00. Illustrated. The Waverly Press, Inc., Mt. Royal and Guilford Aves., Baltimore 2, 1951.

This impressive volume is an anniversary number dedicated as a tribute to Dr. Henry L. Jaffe, whose eminence as a pathologist has been recognized beyond the borders of our country, because of his original contributions during the past 25 years of service in the domain of his specialty. In science or medicine it is a bit of a novelty to see one honored for distinguished service at an age far below the period when it is customary to be revered for one's past labors. Henry L. Jaffe has earned this distinction because of his brilliance in research. So notable is his intellectual honesty and communicable enthusiasm as to capture the respect and affection of his distinguished colleagues. There is a friendly nuance presiding over this volume which invests it with a personal warmth foreign to the tone in most of the literature on bone and joint diseases. Jaffe's identification for the past 25 years as chief pathologist of the New York Hospital for Bone and Joint Diseases is also a tribute to the cooperative spirit of modern medicine with its opportunities for research, discovery and recognition.

The first essay is an autobiographic sketch of Dr. Jaffe and his fundamental contributions; his reputation is associated with (1) his investigation of the pathologic physsiology of the adrenal cortex and the later isolation by others of the adrenocortical hormone; (2) his studies of the development, structure, growth and the pathophysiologic reactions of the skeletal tissues; and (3) his studies in the past ten years of specific skeletal diseases, a period in which he is also credited with 125 contributions and a forthcoming monograph and textbook. The content of this volume includes 35 original studies by 55 distinguished colleagues, centralized on as many problems associated with bone and joint abnormalities. The listed names of these contributors seem to stem from the top echelon of "Who's Who" in the field of bone and joint disorders and thus assures the most authoritative expression on the topics under consideration. To this the ARCHIVES adds its heartiest felicitations.

MODERN TRENDS IN PHYSIOLOGY AND BIOCHEMISTRY. Woods Hole Lectures Dedicated to the Memory of Leonor Michaelis. Edited by *E. S. Guzman Barron*, Chemical Division, Department of Medicine, The University of Chicago. Cloth. Price, $8.50. Pp. 538 with illustrations. Academic Press, Inc., 125 East 23rd Street, New York 10, 1952.

This valuable book contains some of the lectures of the Department of Physiology of the Marine Biological Laboratory given in the 1950 course in physiology. The 1950 course was to have been dedicated to commemorate the seventy-fifth birthday of Professor Leonor Michaelis but unfortunately, his death converted the celebration into a memorial tribute.

The physiology course of the Marine Biological Laboratory was started in 1898 by Jacques Loeb, who brought to it his fundamental philosophic principles and scientific method, and although the teaching staff has changed many times its guiding principles have been retained. Michaelis, with Loeb, pioneered in the physical and chemical phenomena which in their integration make up the vital life processes. These two great scientists introduced into biology the now well-known physico-chemical methods. This approach, sometimes called molecular biology, has always been the aim of the Woods Hole staff.

There are twenty chapters in this book and each is written by a leading scientist in the subject matter under discussion. The subjects discussed may be arranged in six groups: 1. The physiology of the cell is treated in five chapters; 2. the properties of muscle are treated in three chapters. New methods for the purification of some of the protein components of muscle are presented, the application of thermodynamic principles of muscle contraction, and the transport of material across the muscle and nerve membranes; 3. nerve physiology is dealt with in five chapters; 4. some aspects of the energy necessary for the performance of vital activities as produced by enzyme reactions are discussed in five chapters; 5. the study of the action of foreign agents such as drugs being also the domain of physiology, a chapter on the mechanism of drug action is included; 6. a special chapter is devoted to a discussion of the best known examples of biochemical evolution.

While this authoritative work under the able editorship of Professor Barron of the University of Chicago may not interest the rank and file of physiatrists, it should prove to be of marked value to those who are actively engaged in research or have an active interest in physiology. The sections on nerve and muscle physiology should prove particularly interesting. Each chapter closes with a well selected list of references for further study. The book contains an excellent subject and author index. This volume is highly recommended for those who have an interest in molecular biology.

PRINCIPLES AND PRACTICE OF AVIATION MEDICINE. By *Harry G. Armstrong*, M.D., F.A.C.P., The Surgeon General, U. S. Air Force. Third edition. Cloth. Price, $7.50. Pp. 488, with 97 illustrations. The Williams & Wilkins Company, Mt. Royal and Guilford Aves., Baltimore 2, 1952.

This important volume begins with two absorbing chapters on the history of aviation medicine, continues with problems of pilot selection, with the physiology and pathology of high altitudes, with the effects of noise, decompression, and acceleration, with accidents and emotional reactions, and with problems of air rescue and evacuation, and closes with a discussion of hygienic, sanitary, and protective measures.

Somewhat unsettling the reader's confidence in the book are a multitude of small defects surprising in a third edition. These include the persistent misspelling of "pruritus" (pages 136, 312), careless mathematics (proof that 760 — 47 = 103, page 195), inaccurate definitions (353), baffling abbreviations (433), unexplained recommendations (sage green as the color for tinted lenses, 450), and misuse of the diopter as a measure of curvature (450). More serious is the retention of a mode of thinking implied in the phrase "stigmata of degeneration" (142). The unscientific basis and the vicious implications of this phrase have been brought repeatedly to the attention of the medical world, and it should no longer be mentioned but to be condemned, yet it continues to pass along from one generation of writers to another, so that the index of a recent German book actually lists 2½ columns of entries under the heading "Abartungszeichen." Since these include an extraordinary range of insignificant variations, from webbed toes to misplaced teeth, plus such ill-defined peculiarities as multiple naevi and anomalous color vision, a literal following of this line of thinking takes one straight back to the "Malleus Maleficarum" and reduces physical examinations to the level of witch-hunting. It is earnestly to be hoped that this will be corrected in future editions, especially since a book as important as this one is read with great literalness by students.

On the whole, it is inclusive, practical, and interesting. It is provided with illustrations, bibliographies, and an index, and is attractively bound.

MULTIPLE SCLEROSIS: Application of Rehabilitation Techniques. By *Edward E. Gordon*, M.D. Paper. Pp. 54, with 54 illustrations. National Multiple Sclerosis Society, 270 Park Ave., New York 17, 1951.

This pamphlet outlines a comprehensive program for the care of patients with multiple sclerosis. It is excellent and should be valuable to all personnel in physical medicine. It is furnished without charge.

PHYSICAL MEDICINE ABSTRACTS

The Present Obligation of Physical Medicne and Rehabilitation. George Morris Piersol.

J. A. M. A. 147:1093 (Nov. 17) 1951.

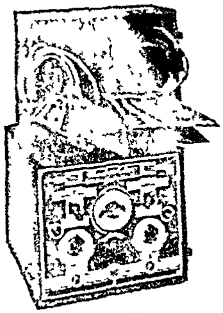
It is only within the recent past that the field of physical medicine and rehabilitation has been given long overdue recognition as an accredited medical specialty. Such recognition, gratifying as it is, carries with it increased responsibilities and definite obligations. The obligations which physical medicine must meet fall into two categories: (1) those of immediate concern, the result of present circumstances, and (2) long range obligations which have developed insidiously, are of indefinite duration, and continuously tax us. The obligations of physical medicine are not limited to the circumstances that have grown out of what we hope is a temporary situation. As the life expectancy in the United States is increased, and more people survive to old age, the greater becomes the incidence in our population of chronic degenerative diseases. Since physical medicine, as presently understood, offers the most rational approach to the management of this group of individuals, physiatrists will be called upon more and more to care for the chronically ill. The obligations of physical medicine arising from the care of our civilian population are not limited to the treatment and reeducation of the chronically ill. To that load must be added the stupendous number of those injured in accidents that annually place such a huge medical and economic burden upon our nation. It is generally admitted that the civilian needs for physical therapists and physicians qualified in physical medicine far exceed those of the governmental agencies. The solution of this problem may be stated in the single word "education." Broadly considered, the word implies arousing among physicians, students of medicine, and the public an interest in, and appreciation of, the requirements and potentialities of broad, well integrated reconditioning programs. Certification in physical medicine, as in every other specialty, is becoming more and more a necessity as governmental and private agencies continue to insist upon it as a prerequisite to responsible professional positions. If the number of physicians who become certified each year does not show a prompt and considerable increase, it will be a long time before we can hope to meet the demand for certified physiatrists. The first remedial step is to expand in our undergraduate medical schools the teaching of physical medicine. In order that education in physical medicine should continue, a tour of duty in that department should be made a part of the training program of every intern. More familiarity with physical medicine will encourage interns to seek residencies in this field. An effort has been made in this education to indicate some of the obligations which face physical medicine. The underlying problems involved are many and complicated. Their solution is difficult and will require time, wisdom, and well directed effort. The record of our past accomplishments leaves no doubt but that the present and future obligations of physical medicine will be met successfully.

Physical Treatment and Rehabilitation of the Hemiplegic Patient in General Practice. Odon F. von Werssowetz.

Am. Pract. 2:963 (Nov.) 1951.

In an average case of hemiplegia, because of the long duration of treatment, it is not practical to have the patient hospitalized or brought to a clinic several times a day for treatment by skilled therapists. Neither is it practicable to have a physical therapist visit the patient in his home as often as treatment is indicated. Obviously, the physician himself cannot undertake the actual administration of a retraining program but should delegate it to a member of the family who can conduct the activities under his supervision. With a program of this kind, many of the complications usually associated with hemiplegia can be avoided. If the treatment is started early, limitation of motion can be prevented in the affected extremities. If, however, the patient is not treated early, contractures usually occur first in the shoulder and foot and later in all joints. The over-all aims of physical treatment and rehabilitation in general are: To prevent and correct deformities; to improve muscle function, and to increase functional capacity by: (a) retraining the patient in ambulation; (b) reestablishing the function in the affected upper extremity as far as possible, and teaching the patient to perform activities essential to daily living with the unaffected upper limb; and (c) training in speech, if such disability is present.

In recent cases of hemiplegia, maintenance of the proper bed position is all that may be required to prevent deformities. There may be no need for any special procedures to protect the affected limbs, though a support for the bed clothes — to keep them off the foot — is advisable. Gentle passive movements, through the full range of each joint, should be administered at least twice daily, for adhesions begin to form very early in the first week. When formed, they are difficult to remove. Gentle movements may be administered through the use of pulleys. Pulley therapy, when administered by the patient, has the advantage over the usual stretching exercises that are done passively, for the patient, knowing his own pain threshold, will proceed to full tolerated motion much more quickly. Pulley therapy also can be used to aid in the reestablishment of reciprocal motion patterns. Quadriceps setting exercises should be started early, as this muscle is one of the *first to*



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CHICAGO SOCIETY OF PHYSICAL MEDICINE AND REHABILITATION

The first meeting of The Chicago Society of Physical Medicine and Rehabilitation for the 1952-53 season will be held on Wednesday, September 24, 1952 at the Stritch School of Medicine, Loyola University, 706 S. Wolcott Street, Chicago, 8:00 p. m. Dr. Y. T. Oester and Mr. Edward P. O'Malley will present the topic "Recent Experimental Studies in Iontophoresis."

Contents—Oct. 1952

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ORIGINAL ARTICLES

The Training of the Physiatrist. Robert L. Bennett, M.D. 585

The Fight Against Poliomyelitis. Everybody's Business. Basil O'Connor 589

An Objective Method of Evaluating Muscle Tightness. William J. La Joie, M.D., and Jerome W. Gersten, M.D. 595
Discussed by Drs. Bruce B. Grynbaum, and La Joie.

Studies of the Effect of Massage on the Flow of Lymph From the Foreleg of the Dog. Margaret P. Ladd, B.S., R.P.T.; Frederic J. Kottke, M.D., and Russell S. Blanchard, M.D. 604
Discussed by Drs. L. B. Newman; Kottke, and Miss Ladd.

Vocational Testing in Educational Therapy. Llewellyn H. King, M.D., and Gus W. Dyer 613

•

Editorial 619

•

Medical News 621

•

Book Reviews 625

•

Physical Medicine Abstracts 631

•

EDITOR OF THE MONTH
ARTHUR L. WATKINS, M.D.
Boston, Massachusetts

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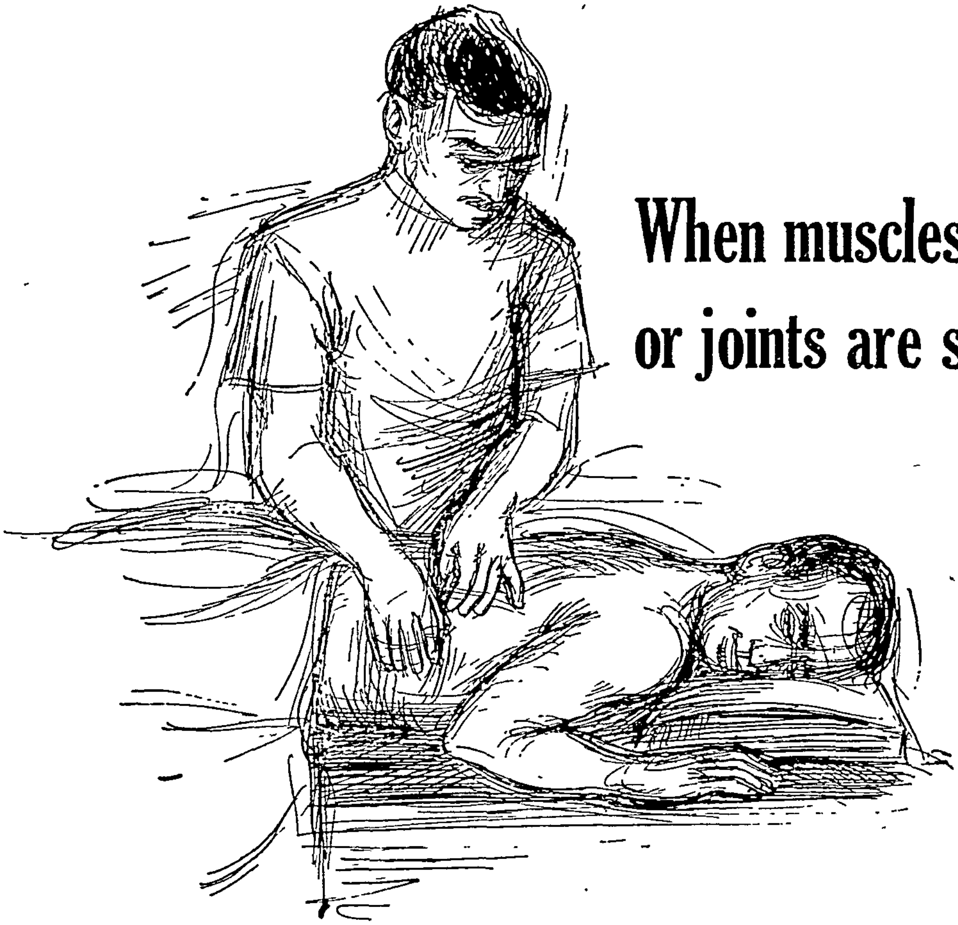

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THE TRAINING OF THE PHYSIATRIST *

ROBERT L. BENNETT, M.D.

Georgia Warm Springs Foundation,
Warm Springs, Georgia
Emory University Hospital,
Emory University, Georgia

It is reasonable to assume that training in any branch of medicine must be based first, on the known demands that will be made of the specialist in actual practice and second, on the trends that appear to indicate the future pattern of practice in that specialty. In new or in rapidly expanding fields it is likely that the present demands as well as the future possibilities may be difficult to define with any degree of accuracy. The problem of training is likely to be confused and inadequate unless the teachers remain students and teach only as they continue to learn. The training of the Physiatrist is in this position today.

Even though we appreciate the stabilizing influence of recognition by the American Medical Association and the ever increasing numbers of men coming into the field, it must be admitted that we still cannot clearly visualize any but the most prominent features of the Physiatrist and but sketchily outline the boundaries of his field. Because of this, it seems hardly necessary to emphasize that the formal post graduate residency in physical medicine and rehabilitation, important as it is, can be but one phase of the training of the Physiatrist. Training must not only be given young physicians interested in specialization, but must be given to the specialist for the extent of his professional life. This latter training is the mutual responsibility of all Physiatrists in our daily practice and, perhaps most important of all, the responsibility of the professional organizations that represent our field of physical medicine and rehabilitation.

In the not too distant past, the specialist in what is now known as Physical Medicine bore little resemblance to the specialist of today. At that time he was simply a physician or surgeon who became interested in some one of the physical agents and emphasized its use in his practice. In this way almost every physical agent that we use today as only a part of the over-all treatment in carefully selected disease conditions, was at one time used in, and frequently claimed to be the cure for practically all the ills of man. As the more specific values and limitations of these physical agents were realized, it was logical that they should be grouped together and placed under the supervision of a physician trained in their proper application. This physician became a Physiatrist, that is, a specialist in the use of physical agents in the diagnosis, prevention and treatment of disease. Because he dealt primarily with tools to be used in the treatment of patients of other specialists, and because his prescriptions for the use of physical agents were carried out in whole or in part through the hands of trained therapists, he was required to become an administrator as well as a physician — in some cases perhaps more of an administrator than a physician. Through his efforts, research of the highest caliber has given scientific justification of empiric findings, at times limiting but often expanding the application of these physical agents.

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* Presidential Address, read at the Thirtieth Annual Session of the American Congress of Physical Medicine, New York City, August 26, 1952.

New tools were discovered and old ones modified for greater effectiveness. A solid foundation was laid and is being built upon today.

But the trends of today point toward a somewhat more varied pattern for tomorrow. As the usefulness of physical agents in medicine became better understood and their effectiveness in rather sharply defined fields of practice became evident, it was only natural that the Physiatrist developed particular interest in those diseases in the care of which his tools, his skills and his facilities played a major role. He began to specialize in these diseases. In general, these were, and are, the subacute and chronic diseases that limit effective bodily movements, with psychologic, vocational and social implications far beyond the care of the physical handicap itself. Thus physical medicine and total rehabilitation of the physically handicapped became a reasonable alliance.

This specialization in the over-all problems of these diseases is an important and very necessary part of the development of our specialty. It seems unlikely that our future will be determined by the continued development of electronic apparatus and of exercise routines, particularly as applied to the patients of other specialists. If certain existing problems in medicine appear to be solved best by the skills and facilities of the Physiatrist, he must be thoroughly trained in those diseases. Those diseases, in whole or in part, should be considered his responsibility if he consistently achieves the more rapid and complete control of them. The line dividing medical specialties can never be sharply drawn, simply because specialties do not create diseases. The diseases create the specialties by their demands for specialized interest and skills. No specialty can claim the sole right to care for any problem in medicine unless its results prove consistently superior to those of all others.

One of the advantages of focusing attention on specific diseases is that our own research arising from the challenge of these diseases is more likely to specifically benefit the field of physical medicine and rehabilitation. The value of discoveries made by any field might well be appraised on the basis of their benefit to all branches of medicine; but perhaps it cannot be considered wholly selfish to wish to promote one's own field first and the other fields second.

It should be obvious that a residency program cannot be expected to turn out a finished product, but at best should be considered the most practical means of bringing into sharp focus those problems of diagnosis, prevention and treatment that come within the responsibility of that field in which the specialist is expected to be expert. The resident's past experience in medical school and internship dealt first with the foundations on which all medical specialties are built and later with outline training in each. At this stage of his career the young doctor probably knows more about all phases of medicine than he ever will again. This permits him to select the several fields of his greatest interest and to take advantage of opportunities for further training in any one of these fields. He is attracted to a field for one or a combination of several fairly evident reasons, such as the general type of disease treated, the financial return possible, the prestige inherent in certain specialties, and the possibilities for rapid advancement. In the final analysis, however, the student and intern is influenced by what he sees is being done by the specialist with whom he comes in contact. Therefore, the ability of a specialty to attract young graduates must ultimately depend on the representation of that specialty in the medical school during his internship years. It is beyond the scope of this paper to discuss curricula at any level of training, but it is necessary here to emphasize that during these important medical school and internship years, physical medicine must be clearly represented as a specialty, and not only as the study of a group of physical agents with application in practically every field of medicine and surgery.

If this brief discussion of the present and probable future of physical medicine is valid, and if the Physiatrist is to be a specialist in diseases as well as in tools. the essential content of an adequate residency program is evident. In broad outline it must encompass the following essentials:

1. — *Training in those basic sciences necessary to intelligent prescribing as well as to personal application of the fundamental physical agents identified with physical medicine:* At this level of training there seems little justification in repeating formal courses of preclinical sciences already covered in the premedical and medical school years. The necessary knowledge and skill is better taught in most instances by the specialist with broad experience in patient care. Part of this training should be spent in guided scientific evaluation of the merits of physical agents, if possible with facilities for basic and clinical research, certainly with specific responsibilities in the use of the medical library.

2. — *Training in the diagnosis, definitive treatment, and total rehabilitation of patients with those subacute and chronic diseases affecting bodily movements in which the use of physical agents constitute major therapy:* This training must include specific instruction in allied fields, particularly Neurology, Psychiatry, Orthopedics and Internal Medicine, so that the certain basic knowledge and techniques in these fields may be used by the Physiatrist in his practice, and so that specialists in these fields may be consulted intelligently by the Physiatrist when necessary to total care. This phase of training should be provided by services dealing with men, women and children, and should be designed to develop specialists in total care. It should be evident that residency programs can no longer be considered adequate if they provide little more than training and supervision of ancillary personnel, or if they are limited to patients of certain age and sex.

3. — *Training in departmental supervision and direction:* This training should include over-all hospital administration to acquaint the physician with hospital management so that he can appreciate the necessary administrative, professional and financial responsibility of all the component parts that make up the modern hospital or clinic.

4. — *Training in the therapeutic purpose, educational background, potentials or limitations of recognized ancillary personnel upon whom the physiatrist must depend for certain phases of patient care:* This should include appreciation of the historical background and scientific contributions of these groups so that the physician's responsibilities to them is just and without prejudice.

5. — *Training in the proper utilization of and cooperation with national, state and local agencies, both governmental and private, that are capable of assisting the field in its development and the patient in total care:* This must entail some instruction in laws at the several levels of government concerned with the disabled individual.

6. — *Training in the professional purpose and accomplishments of existing organizations that represent the field of physical medicine:* This training should also emphasize the responsibility of the Physiatrist to these organizations.

Undoubtedly the greatest responsibility for the training of the Physiatrist, after his residency training is finished, rests with the organizations representing physical medicine and rehabilitation. These organizations must in large part determine the future of this specialty. Obstacles to the full development of this specialty still exist. Fortunately, the problem of recognition is well on the way to solution, but cannot be completely solved until every medical school, hospital and clinic consider physical medicine and rehabilitation an essential part of its service. This seems assured if we continue to develop and maintain high levels of professional competence. If this is so, then our greatest problem today is the development of a unity of purpose.

Until the boundaries and content of this specialty are more specific, there will always be danger of divergence of effort and direction. The development of specialties within specialties is an indication of progress, and is inevitable in the broad field of physical medicine and rehabilitation. Likewise, the very nature of the specialty requires the development of ancillary personnel with extensive and multiple skills. These developments, while necessary, are not without their dangers. The Physiatrist, through his organizations, must be taught not only to develop and guide these necessary skills but also must be taught the importance of maintaining leadership and control over these groups.

The American Congress of Physical Medicine and Rehabilitation must continue to critically reflect that which is best in physical medicine and rehabilitation in the United States. Its annual meetings must continue to acquaint all other fields of medicine with the possibilities of this field. But above all else it must point the way to the future and mold the field into a tightly bound, scientific and purposeful group. Local sections of this Congress, smaller national and local organizations, must support the over-all work of the Congress by more specific scientific programs and teaching seminars, and in this manner indicate the trends and patterns for specialized training. The American Board of Physical Medicine and Rehabilitation is one of eighteen boards representing recognized medical specialties. Its representation on the Advisory Board of Medical Specialties enables it to set up and maintain standards consistent with those of other specialties. In this way the Board can be of great service. However, at best, a specialty board is simply a watch dog guarding the portals of specialization and can do little more than carry out the orders of the specialists within. The recent formation of the International Congress of Physical Medicine was a highly important and necessary step toward unity of purpose. The first meeting in London was impressive and inspiring. It must be supported by all of us in the field.

It should be emphasized that the training of the Physiatrist rests with each of us, in our residency programs, our daily contacts with each other, and in our professional organizations. Physical medicine and rehabilitation is not so much endangered by its relatively small numbers as it is and has been by attempts to fill responsible positions with untrained men. Many of the problems that plague us today can be traced not only to lack of training in the disciplines of the specialty but also to lack of training the Physiatrist in his responsibility to the specialty.

The problem of recognition has been largely solved. The other problems are many, but all can be solved by knowing where we're going and training men to get us there.

* * *

THE FIGHT AGAINST POLIOMYELITIS *

Everybody's Business

BASIL O'CONNOR

President, National Foundation for Infantile Paraylsis

NEW YORK

When your president, my good friend Dr. Robert L. Bennett, asked me to talk to you tonight, I accepted that invitation promptly and gladly.

We are not strangers. Despite our different techniques we are co-workers in a great humanitarian effort. We have many problems yet to solve.

As the result of being president of the National Fouhdation for Infantile Paralysis for 15 years, I have a keen interest in physical medicine and rehabilitation, and I have a very real personal interest, too.

For a quarter of a century I have witnessed, at first hand, the impairment of human bodies by an epidemic, crippling disease — poliomyelitis. For a quarter of a century as a layman I have worked with you and many others seeking to solve the problems arising from widespread incidence of this disease throughout the nation. My service goes back to the days when rehabilitation, at least as applied to the poliomyelitis patient, often consisted only of getting acquainted with a pair of crutches. My first full comprehension of the meaning of rehabilitation came as I watched the grim struggle between Franklin D. Roosevelt and the disease to which he refused to surrender. And, with him, I became acutely aware that there were others — thousands upon thousands of others — who needed help. But adequate assistance was not available to them because society then was not equipped to give it. The reasons were many — lack of knowledge, lack of equipment, lack of personnel, lack of money, and some apathy. Whatever the cause, the poliomyelitis patient of twenty-five years ago was pretty much on his own.

Today, after all these years of fighting poliomyelitis, I am more vitally concerned than ever before with the needs of those who are struggling to overcome disabilities resulting from any disease. That is the natural development of sincerity in this kind of humanitarian activity. It is never possible to let down in a fight such as this, once it has been joined. Yet every advance seems to uncover new areas of need. Every accomplishment suggests a new point of attack.

I wish I could say that after our numerous successes in the fight against poliomyelitis, the conditions of twenty-five years ago had been completely eradicated, that science and medicine and the American people had reached the point at which maximum rehabilitation is assured for every poliomyelitis patient in the nation. I wish I could say further to you that every community has available the facilities, the personnel and the funds for a fully effective rehabilitation program, not only for the victims of poliomyelitis, but for the hundreds of thousands disabled by other diseases, by wars and accidents, and by congenital abnormalities. You know how untrue such statements would be. Despite the fact that much has been accomplished in creating techniques, therapies and prosthetic appliances that open up new worlds of activity for many handicapped persons, we know that we are merely scratching the surface in applying the knowledge we already have on the gigantic scale necessary to reach all who need help.

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* Delivered at the Thirtieth Annual Session of the American Congress of Physical Medicine, New York City, August 27, 1952.

Let me indicate some of the real and interesting problems that confront the National Foundation — problems in the solution of which you are interested because poliomyelitis patients look to you so eagerly for help. Across the nation, poliomyelitis once again is filling hospitals and clinics with its victims. From present indications, it appears that 1952 may be the worst poliomyelitis year of all time. We hope it will not be. But whether it is or not, it is already apparent that many more of our people will be added to the lists of the physically disabled. We are concerned, of course, because the annual incidence of poliomyelitis is remaining at a high level, year after year, with no respite. By the end of 1952 it will be a matter of record that the past five years were the heaviest epidemic years in the nation's history.

But other aspects of the epidemic pattern call for attention if we are to meet the obligations of the future. Poliomyelitis is no longer confined to several high-incidence areas each year. Today, in addition to numerous points *of extreme emergency, the disease has spread out to a lesser degree across* every section of the country. The result is a cumulative impact that is not easily absorbed. Where the disease was once a special problem in a relatively small number of communities each year, today it has become a continuing burden for thousands of communities in every one of the forty-eight states. The National Foundation first met the challenge of poliomyelitis epidemics by a centralized defense system. With headquarters in New York as the guiding force, help was given to an emergency area not only directly but also channelled from the surrounding states, and sometimes from points thousands of miles away. Nurses were recruited through the American Red Cross for epidemic duty, physical therapists were secured through the American Physical Therapy Association, and the entire resources of personnel and equipment from unaffected areas were made available to the point of need.

To a great extent, this system is still the mainstay of our epidemic defense. But its operation is becoming increasingly difficult. Today, when the call goes out for physical therapists, nurses, and other skilled workers necessary for the proper care of the poliomyelitis patient, the answer is a growing dearth of such personnel free to serve outside their own communities. Most localities now have their own problems. Five years of heavy epidemics have left their mark all over the nation. Every community has its backlog of residual cases that are being treated on a continuing basis. And over all hangs the constant threat of new attacks, and the fear that if they surrender their own workers, they will find themselves unprepared when the blow strikes at home. Unfortunately these fears too often mature into reality. Such was the case in Sioux City, Iowa, where 22 poliomyelitis patients were admitted to hospitals in a single 24-hour period just a few weeks back. Such pressure, suddenly exerted upon hospital staffs, may jeopardize the entire patient-care program of the community, unless the crisis is met, and met quickly.

This year, as early as the first week in August, serious shortages of trained personnel brought appeals for help from such metropolitan areas as Chicago, St. Louis, Detroit and Cleveland; from Dallas, Houston, New Orleans and Baton Rouge; from Omaha, Louisville, Sioux City and Des Moines. Their local reservoirs of physical therapists and nurses had been exhausted. They could not help others. They needed help themselves. Translate this into the plight of rural and semi-rural areas which normally depend upon the metropolitan areas to assist in emergencies, and the over-all problem becomes obvious. The little community of Sparta, Wisconsin, with a population of

6,000 persons, suddenly found itself with 22 cases of poliomyelitis. Among the 58 residents of Prue, Oklahoma, 8 had infantile paralysis. Sherman, Texas, with a population of 20,000, had 27 cases. These are the kinds of reports we've been getting for the past several months. And they are all early reports, with the heaviest poliomyelitis months still to come.

How do we face up to this situation? How do we meet the fact that we cannot fill all present and future personnel shortages on a volunteer recruitment basis? It is not a question of money. Financial responsibility for the temporary redistribution of skilled workers, including travel expenses, maintenance and, in some cases, the supplementing of salaries on emergency duty, is borne by the March of Dimes. It is a case of having skilled human beings physically present at the side of the patient when they are needed. They are needed today, and they will be needed tomorrow and the next day, until long after the epidemics have been forgotten. But we will not have them, because they do not exist in the numbers needed.

A few years ago, when it became apparent that the pattern of poliomyelitis incidence was undergoing a change, we began to put more emphasis upon community responsibility. It was realized that a completely-centralized defense system was not the answer to widespread poliomyelitis. It fails initially because there just are not enough trained people to go around, and it fails also because existing resources of personnel are not equitably distributed throughout the country. If we are to meet the challenge of continued widespread incidence, with its inevitable toll of residual cases spread far and wide across the nation, it is imperative that we seek methods of making existing services go farther than they now do, until such time as our supply of trained personnel is intelligently increased.

We are all agreed that, whether it is in the rehabilitation center or the clinic, the hospital or the home, every effort must be made to shorten the period of the patient's dependence upon others. This can be done only if we recognize that the person stricken with paralytic poliomyelitis starts to get well from the moment he gets sick. The process of rehabilitation then becomes everybody's business. Everyone who normally comes in contact with the patient is involved in the pattern of getting well — his parents, his sisters and brothers, his physician, the nurse, the physical therapist, the medical social worker, the psychologist, his companions and his school mates. The concept of medical team work must be brought into play, with every member of the medical team cooperating to develop a total program of rehabilitation. The physician in charge is, of course, the natural leader of the team, a leader who, while he cannot be expected to know all there is to know about the many specialties that may be needed, must have a good concept of the job at hand. He must be able to recognize those cases in which the patient needs specialized service, and he must be able to see that service in relationship to the total problem of rehabilitation.

It is indicative of a total lack of knowledge of the situation that exists to think, at this time, that every disabled person who requires specialized services can be cared for at a specialized hospital under the direction of a specialist. The nation has neither the facilities nor the personnel to carry out such a program. The medical direction of the vast majority of poliomyelitis cases will continue to fall to the general practitioner, the pediatrician, the internist, the physiatrist, the orthopedist, the neurologist or other physician who is called in by the patient's family. It will be fortunate, indeed, if there is a physical therapist or occupational therapist in the community who can provide needed services under the direction of the attending physician.

It is the aim of the National Foundation to train more personnel in the whole field of physical medicine to fill at least some of the needs of the average community, where specialized facilities are non-existent. The program of physical medicine and rehabilitation is one of our major efforts. We are convinced that this is the most practical way of helping these patients. We look to the specialized physician, and particularly to the physiatrist, to share his knowledge and training with other members of the medical team to accomplish the mutual goal of maximum recovery for the patient. With this broad concept of rehabilitation in mind, the National Foundation is planning realistically today to meet tomorrow's problems. We have not in any way weakened our centralized defense system. But we are exerting every effort to build in each community a framework of knowledge that will permit the local health team to handle normal poliomyelitis incidence with the facilities and personnel at hand. The problem is one of creating the concept of rehabilitation in the minds of all whose services are needed by the patient. With some training and preparation, it is felt that many communities should be able to handle this problem with a minimum of outside help. We are fully aware that in the face of a full-scale epidemic no community can stand alone, and it is for this reason that we cannot abandon centralized emergency operations to provide money, personnel and equipment to hard-hit areas. But we will be in a better position to meet these true emergencies when we have encouraged every community to maximum self-help.

To carry out this program, the National Foundation already has spent 14 million dollars to prepare more qualified personnel in needed fields, and to promote professional and lay education regarding poliomyelitis. The National Foundation does not engage directly in the training of personnel, nor does it employ individuals for the practice of medicine and related professions. Through scholarships and fellowships to qualified individuals, we have financed their education and training at recognized institutions of learning, stressing those fields where shortages have been most acute. Since the National Foundation's professional education program was inaugurated in 1945, approximately 3,000 scholarships and fellowships have been awarded with March of Dimes funds. This is the largest program of its kind in existence today among the voluntary agencies. These awards have been given without any attempt to "corner the market" of professional workers in medicine and its related fields. The National Foundation has no strings on these men and women when their training is completed. They are not compelled by agreement to work exclusively with poliomyelitis. We have felt, instead, the need for increasing the availability of necessary services and broadening the concept of their value. If that can be accomplished, our specific interests will be advanced along with the others. I have said that every successful effort of the National Foundation has uncovered new needs that must be met. This has been especially true in the field of education. When the public gave enough money to warrant a major effort in that field, the National Foundation encountered the sometimes not well known fact that you just cannot go out in the market and buy hundreds of additional physical therapists, orthopedic nurses, or whatever you happen to need. Furthermore, we learned that the personnel shortage extended back as far as the teachers in these fields. Many schools lacked sufficient funds to develop properly their teaching programs. In most cases the programs required expansion. Standards of instruction were high in some places, dangerously low in others. All these things claimed attention from the moment of the National Foundation's very first effort in the education field, and with each passing year we have applied ourselves more diligently to helping others create a sound base from which can arise an army of trained workers whose skills may be applied to the care and rehabilitation of the thousands of physically disabled individuals who will need medical assistance for many, many years to come.

The impact of the National Foundation's education program on the field of physical therapy alone has been truly dramatic, although, no doubt, the general public is hardly aware of our activity in this respect. It is cited merely as an example illustrating how we have been trying to cope with this increasing problem of lack of qualified personnel.

In 1944, there were less than 1,000 physical therapists in the United States who were not involved in armed services programs. And nothing was being done about it until, in conjunction with the American Physical Therapy Association, we went to the administrators of the physical therapy schools and asked what we could do to strengthen this vital profession. This resulted in the initiation of a three-point program of assistance with an outlay of $1,300,000 in March of Dimes funds. We agreed to provide scholarships for students of physical therapy, we agreed to provide for the education of teachers for physical therapy schools, and we agreed to assist the Association in maintaining and improving standards of physical therapy education and employment.

By the end of last year, more than 1,800 physical therapy scholarships and 31 teaching fellowships had been awarded. Assistance had been given to 11 schools to improve their programs of instruction and enlarge their enrollment. At four schools equipment was provided for therapeutic exercise. The National Foundation has financed the development of teaching aids and made it possible for medical and technical directors of physical therapy schools to confer on their mutual problems and exchange ideas, opinions and information. At the close of World War II, when interest lagged in supporting schools of physical therapy, continued March of Dimes aid made it possible for at least one-half of all physical therapy schools in the country to continue their educational programs. As a result of this intensive effort by the National Foundation, there has been a substantial, though in no sense a sufficient, increase in the number of qualified physical therapists available not only for victims of poliomyelitis, but for all disabled persons. There has been a definite improvement in educational standards and in employment practices. And the ground work has been laid for educational programs that will continue to produce skilled workers for many years to come.

In the field of physical medicine, the National Foundation has long recognized the need for more physicians trained in this specialty. In 1943, funds were appropriated to assist in the development of a teaching and research program at the University of Pennsylvania. Since that time we have given financial assistance to five other medical schools in support of teaching programs in physical medicine at Emory University, Meharry Medical College, New York University, Washington University and Yale University. We have awarded 36 fellowships of from one to three years' duration in physical medicine. The result of these efforts is not immediately visible. It will take some time before the effect is felt in the community. But there is no shortcut to a solution of skilled medical personnel shortage.

In the attempt to develop a high degree of self-sufficiency on the community level, other problems were encountered. In the early years of the National Foundation, our local Chapters found their patient-care programs complicated by the fact that few hospitals would admit acute poliomyelitis patients. Most patients had to be cared for in the home, and our early efforts, therefore, went into the development of teaching programs in home care, through the national organization of public health nursing. But the need for hospital care became more apparent with each year that passed, and so attention was directed more and more to convincing hospital administrators and public health authorities that early hospitalization in the acute stages of poliomyelitis sometimes spelled the difference between life and death, between normality and disability. As a result, hospital doors began to open to the poliomyelitis patient. And again, success was accompanied by new and more intricate problems. It was found that standards of care differed tremendously from hospital to hospital. Some hospitals were ill-equipped and inadequately staffed for the care of poliomyelitis patients. And, since the National Foundation's funds are public funds, it became necessary to measure carefully the quality and quantity of care received for the money expended. It became necessary to establish standards of care and tables of costs —no simple matter when applied across the entire nation. When the National Foundation was established in 1938 we had no idea how deeply it would shortly be involved in the basic health problems of the nation. But these issues were not ignored. The National Foundation faced them, working with hospitals, local health authorities, medical groups and public-spirited citizens. Assistance was given to the institutions wherever possible, and aided them in establishing effective programs of patient care.

Unfortunately, as a result of the opening of more hospitals to acute poliomyelitis patients, the public and many members of the medical profession came to think of the ailment as a disease requiring long periods of hospitalization. Actually, a survey of hospitals covering the period from June to November, 1950, showed that only 24 per cent of the patients remained in the hospital more than thirty days, and only eight per cent for more than 90 days. When one considers the dangers of psychic trauma, particularly for children separated for the first time from the security of their homes, it becomes necessary to examine closely the extent of hospitalization needed in each case. One of the National Foundation's major efforts today is the attempt to reduce the number of unnecessary hospital admissions. We are encouraging the use of diagnostic aid teams, working in homes or in clinics, to weed out non-poliomyelitis cases and those that may be treated without hospitalization. The present trend away from hospitalization for all cases is forcing our chapters and our national office to give greater attention to the coordination of all community resources for rehabilitation, such as visiting nurse and physical therapy services, out-patient clinics, vocational rehabilitation when required and, in some communities, the development of the rehabilitation center. With every year that passes, the value of the team concept of rehabilitation becomes more impressive. With every epidemic additions are being made to that team, new skills being employed, new techniques coming to light. It is the responsibility of all who are involved in any way in the process of restoring health to the stricken, to cooperate with one another, to share our accumulated knowledge, and to work toward the eventual enlightenment of all communities to the true meaning of rehabilitation.

Today, when it seems that science may be approaching the moment when control of paralytic poliomyelitis will become a reality, we whose specific interest lies with this disease see only hard work ahead. Long after the disease has been conquered, the thousands stricken in the past will need your help. Along with millions of persons whose lives have been altered by disease and accident, they will look for guidance as they grope for a way of life among their able-bodied fellowmen. As difficult as their lot may be, they will find that they have a distinct advantage over those poliomyelitis patients whom I first met twenty-five years ago. They will find in our present society an understanding of their needs. They will receive intelligent care, and a chance to live again without complexes.

AN OBJECTIVE METHOD OF EVALUATING MUSCLE TIGHTNESS [*]

Preliminary Observations on the Effectiveness of Various Procedures in Producing Muscle Relaxation in the Hemiplegic Extremity [*]

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One of the most distressing difficulties in the rehabilitation of the hemiplegic is the spasticity which limits his functional capacity. Mild applications of heat have been commonly used in the treatment of the spastic extremity.[1-3] This usually includes hot packs,[4] paraffin,[4] and infra-red radiation.[5] More recently mephenesin (Myanesin® Tolserol®) has been used by some to relieve spasticity[6-8] in hemiplegics, while others have found tentanizing current to be of value.[9] All of the above procedures were therefore tested in this study. In addition, because of the relaxing effect of constant current on muscle,[10] and the effect of ethyl chloride spray in relieving the pain and spasm in myositis,[11] these two procedures also were studied.

Evaluation of the effect of these procedures in relieving spasticity has been difficult. Many techniques have been used in an attempt to measure the degree of spasticity in hemiplegia. Measurement of the height of the knee-jerk[12-13] and of the height of quadriceps contraction[14] proved to be too variable to quantitate. Various mechanical procedures have been devised in which the acceleration of an extremity in response to an external force was used as an index of the degree of spasticity.[15-17] More recently electromyographic techniques have been utilized to quantitate spasticity.[18-21] With the

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[*] Read at the Twenty-Ninth Annual Session of the American Congress of Physical Medicine, Denver, Colorado, September 6, 1951.

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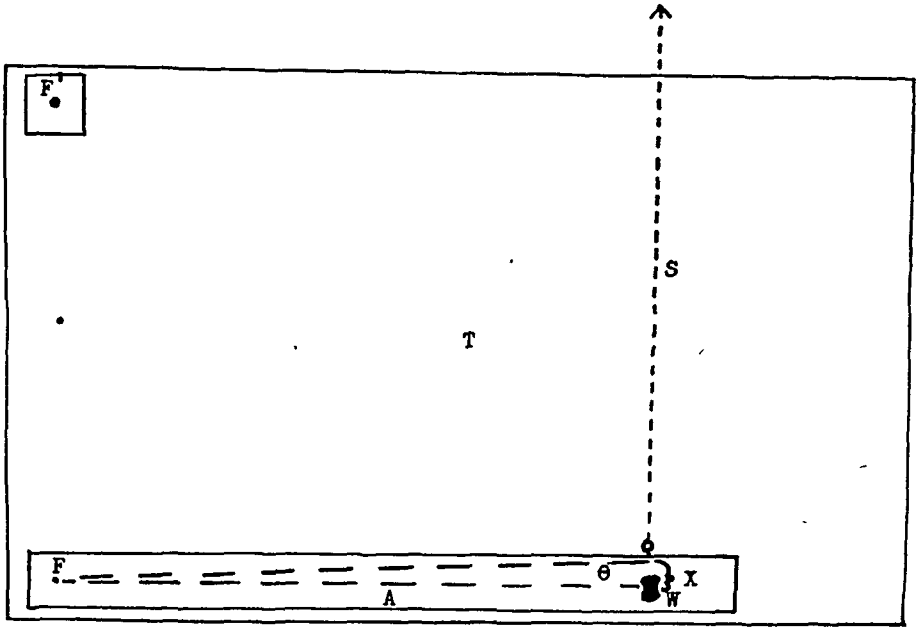
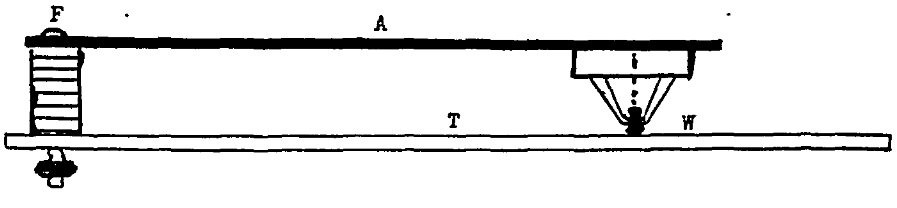


VIEW FROM ABOVE



SIDE VIEW

Fig. 1. — Diagram of Apparatus Used to Measure Resistance Offered to Passive Extension at the Elbow. A-Arm board to which forearm is strapped: T-Testing Board over which the wheel at the free end of the arm board rolls: F and F'-Axes of rotation for testing left and right arms, respectively: W-Wheel mounting: FW-Radius of the arc, 37.5 cm.: θ-1.5 degrees of extension: X-1 cm. of movement on the arc: S-String going from arm board to pulley and weight pan.

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exception of electromyographic studies during Mephenesin (Myanesin®) administration,[8-22] however, the effect of therapeutic agents on the degree of spasticity was not evaluated.

It was therefore felt desirable to devise a simple procedure for determining quantitatively the resistance that the spastic muscle in hemiplegia offers to extension, and to determine the effect of therapy on the resistance to extension. The method to be described differs from mechanical methods previously used mainly in that the force required to initiate motion is measured, whereas in earlier methods the force required to maintain motion was measured.

Procedure

All studies were made on the elbow flexors, measurements being made of the resistance to extension at the elbow. The "test board" (T in Figure 1) used to determine the resistance of the forearm to extension, was rectangular (60.5 x 37.5 cm.), with a mobile arm board (A) attached to it in such manner that there was a vertical axis of rotation (F) at one end and free motion at the other (W). The patient was seated, with the arm abducted 85 to 90 degrees, and the forearm placed on the mobile arm board (A), with the elbow directly over the axis of rotation (F), and the hand over the freely moving end (W). The forearm was fixed to the arm board by means of straps.

After the patient had been seated for ten to twenty minutes, control readings of the resistance to extension were taken. This procedure consisted of applying a known force at a point 37.5 cm. from the elbow and at right angles to the long axis of the forearm (along line S in Figure 1). Increasing forces were applied until an angular extension of just 1.5 degrees (Θ) was produced. Three readings of the minimal force required to extend the elbow 1.5 degrees were taken at one-minute intervals every ten minutes, until there was only a slight difference between consecutive ten minute readings. The effect of various procedures on the resistance to extension was then studied.

The following techniques were used:

a. Infra-red irradiation of the flexor surface of the arm for thirty minutes with a 250 watt Mazda bulb in a reflector. In some experiments, the bulb was 14 inches from the skin surface while in others it was at a distance of 20 inches from the skin.

b. Hot packs applied to the flexor surface of the arm for thirty minutes, changing the packs every five to eight minutes.

c. Fifteen layers of hot paraffin brushed on the flexor surface of the arm and then covered with wrapping paper for insulation. This was left on for thirty minutes.

d. Tetanizing current to the elbow flexors for ten minutes. Maximally tolerated currents of a continuous sine wave at 60 cps. were used.

e. Galvanic current with current intensity of 20 milliamperes applied for thirty minutes. The anode covered the entire elbow flexor area, while the cathode was placed on the back.

f. Ethyl chloride spray to the flexor surface of the arm for five minutes. During this period blanching of the skin was produced, followed by erythema when the spray was stopped. The spray was always moved in a cephalad direction.

g. Mephenesin (Myanesin®), — a 2 per cent solution of "Tolserol®"* was injected intravenously at a rate of 60 to 80 drops per minute, until 100 to 150 cc. had been given.

Electromyography was done using needle electrodes and either a Grass preamplifier (flat in response from 0.5 to 50 cps.) and Dumont oscillograph or the Meditron unit. The degree of amplification was such that a 10 mm. deflection on the screen of the cathode ray oscillograph was approximately equal to 50 microvolts.

Results

A. In order to evaluate the validity of the method used, three types of experiments were performed. In the first, the normal and the hemiplegic

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* Courtesy of E. R. Squibb & Sons for the purpose of this study.

extremity were compared; in the second, brachial plexus block was performed; and in the third, procedures which were known to produce changes in tone were tested, namely, the tonic neck reflexes.

1. Comparison of normal and spastic extremity (5 observations; 4 hemiplegic patients). The force required to initiate elbow extension was measured at elbow angles of 90 to 150 degrees (figure 2). The resistance to extension was significantly greater in the hemiplegic than in the normal extremity, the difference between the two increasing with the increase in elbow angle.

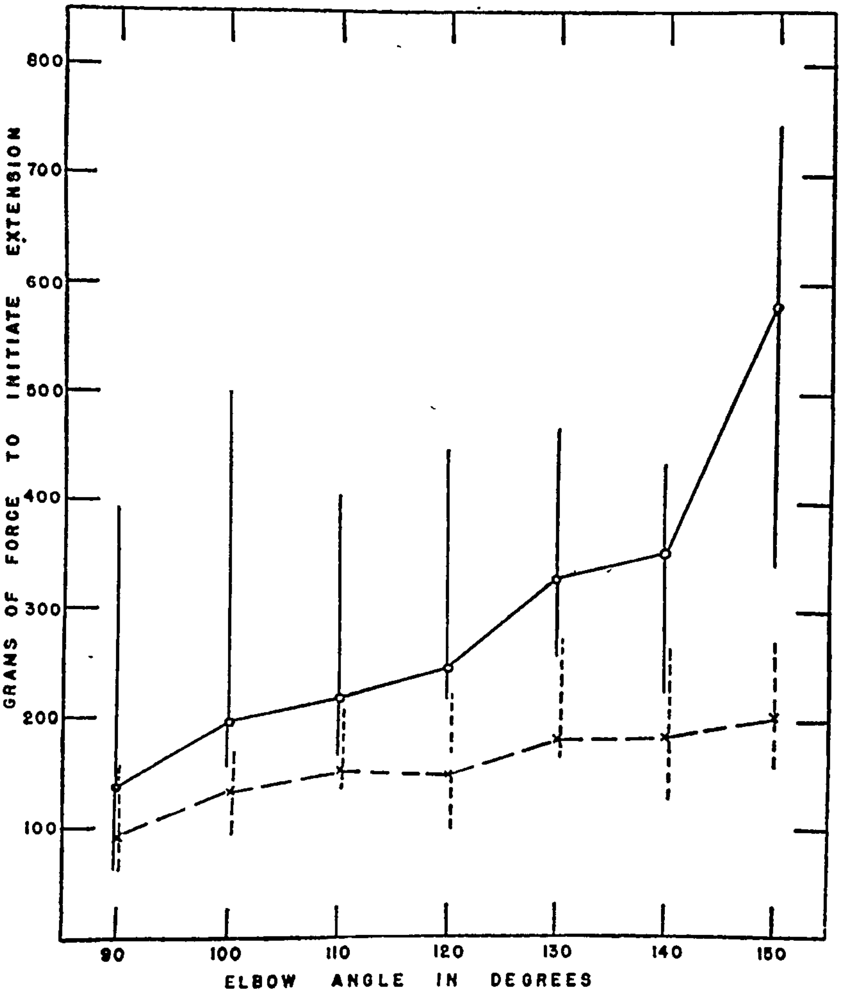

Fig. 2. — Comparison of Resistance Offered to Passive Motion by Normal and Spastic Arms. The curves represent the average of 5 experiments. The ordinate represents the minimal force in grams necessary to passively extend the arm 1.5 degrees. The abscissa represent the initial angle at the elbow at which the grams-resistance was measured. The solid line refers to resistance of the spastic arm; the broken line to the normal arm. The vertical extensions from the mean indicate the range.

2. Brachial plexus block* with 2 per cent procaine (4 observations; 4 hemiplegic patients), effective as determined by sensory and motor examination, resulted in an immediate decrease in the amount of force required to initiate extension. This immediate decrease averaged 47 per cent (figure 3).† The relaxation produced by the block was undiminished for thirty minutes, and then began to decrease. Even at the end of one hour, however, less force was required to extend the forearm than before the block.

3. Tonic Neck Reflexes (7 observations; 5 hemiplegic patients). With the patient in the sitting position, rotation of the head away from the hemiplegic extremity and extension of the head each resulted in consistent and significant increases in the amount of force required to extend the elbow ('p' values of .05—.02 and .01—.001, respectively) whereas head flexion resulted in a significant decrease in the resistance to extension ('p' value <.001). Rotation of the head towards the hemiplegic side resulted in a slight and insignificant increase in resistance to extension ('p' value >0.1), (figure 4).

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* Courtesy Dr. Robert Virtue, Department of Anaesthesiology, Department of Medicine, University of Colorado, Denver.

† The elbow angle used in this and all subsequent observations was 145 degrees.

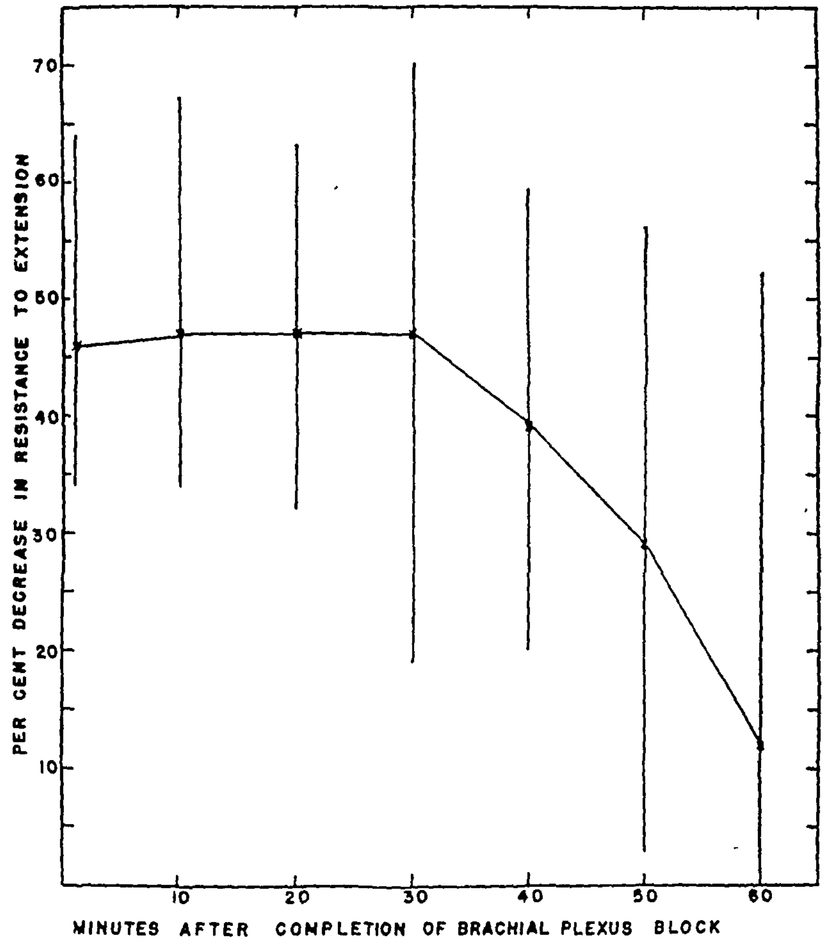

Fig. 3. — Effect of Brachial Plexus Nerve Block on the Resistance Offered by the Spastic Extremity to Passive Extension. The ordinate represents the average per cent decrease in grams-resistance to passive extension of the elbow 1.5 degrees from a starting angle of 146 degrees. The abscissa represents the time after the nerve block. The vertical indicates the range of variation from the mean.

B. Test of therapeutic procedures (Table 1). The only significant changes in the resistance of the forearm to extension followed infrared radiation at a 14 inch source-skin distance, and intravenous injection of Mephenesin (Myanesin®).

The decrease in resistance to extension following infrared radiation at 14 inches is small in amount, but, nevertheless, statistically significant as noted by the 'p' value of the mean per cent change in resistance to motion. In addition, the variability of the control was small; the ratio of the standard deviation to the mean for any one experiment amounting to only 0.03. A 9 per cent change from a mean which has such a small variability is significant. Finally, of the 15 experiments, 11 showed a decrease in resistance to extension following infra-red radiation at 14 inches, 3 showed no change, and only one showed an increase. This average decrease in resistance to extension of 9 per cent was noted immediately after cessation of the infra-red radiation. During the irradiation there was no significant resistance change, while ten minutes after cessation of treatment, resistance values had returned to normal.

Mephenesin (Myanesin®) injection too, significantly decreased the resistance of the forearm to extension. The duration of the injection was forty to sixty minutes. In 4 experiments maximal decrease in resistance occurred ten to twenty minutes after completion of the injection, in 1 ten minutes before termination of the injection and in 1 twenty minutes before the end of injection. The effect of the Myanesin was of longer duration than that

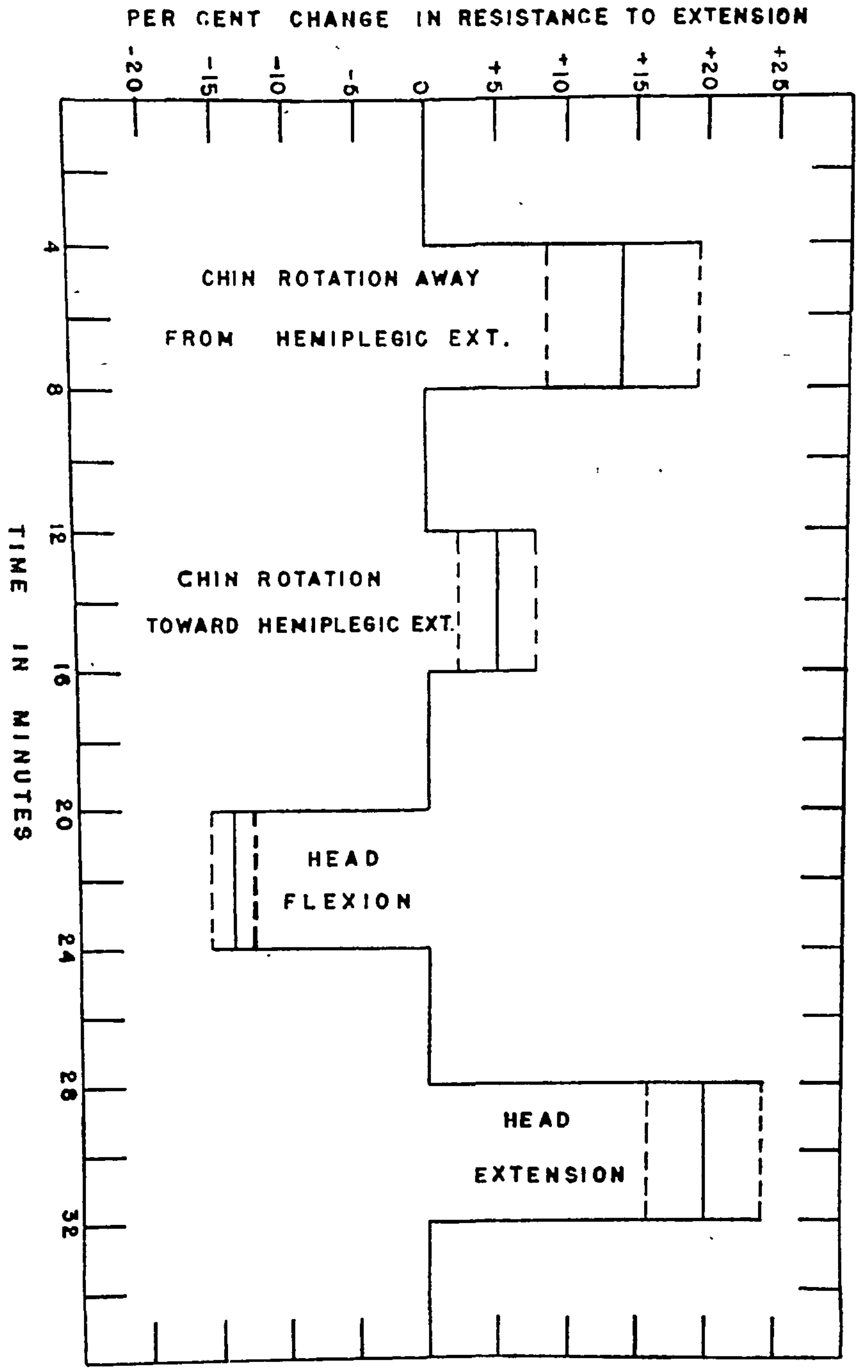

Fig. 4. — Effect of Head Posture on Resistance to Passive Elbow Extension. The ordinate represents the average per cent change in resistance to extension from the resistance present when the head is in the neutral position. The abscissa represent the average time sequence of the experiment and the order in which the head postures were assumed. The broken lines above and below the mean indicate the standard error of the mean.

of the infra-red. Twenty minutes after the maximal resistance decrease of 17 per cent was recorded, the decrease in resistance averaged 13 per cent. Since this was approximately one hundred minutes after the onset of the injection, it was not possible, with the exception of 1 experiment, to keep the subject in one position any longer. In this experiment readings were taken forty minutes after the time of maximal resistance decrease, during which time there was only a slight return towards the normal value.

Blood pressure and pulse rate were followed in 5 of the 6 observations. In none was the pulse rate altered by Myanesin®. In 1 of the 5 there was a slight increase in both systolic and diastolic pressure (116/68 to 138/78),

TABLE 1. — *Effect of Various Procedures on the Resistance Offered by the Arm to Passive Extension of 1.5 Degrees*

Procedure	Number of Observations	Average Per Cent Change[4]	S. E.[1] %	p Value
Infra-red, 14"[2]	15	—9	2.7	.01—.001
Infra-red, 20"[2]	15	—2	2.9	0.5
Hot packs[2]	16	—4	3.7	0.3
Galvanic current[3]	17	—1	2.7	0.7
Tetanizing current[3] (60 cps.)	4	+6	5.2	0.3
Ethyl Chloride[2]	4	+5	9.9	0.6
Paraffin[2]	4	+4	3.8	0.4
Myanesin, I. V.	6	—17	5.5	.05—.02
Brachial plexus block	4	—46	11.5	.05—.02

[1] Standard error of the mean per cent change.
[2] Application to flexor surface of arm.
[3] Active electrode over biceps area, inactive to the back.
[4] Per cent change in the resistance to passive extension produced by the procedure.

while in the others there was no change. In all subjects there was dizziness, drowsiness, slowing of speech, slow response to command, and horizontal nystagmus. In 4 of the 6 patients there was vertical nystagmus.

C. Electromyographic Studies — A needle electrode (coaxial or single) was placed in the spastic biceps at 2 or 3 different points. In 9 studies on 5 patients no action potentials were elicited when the various head postures were assumed. Coughing or yawning, however, elicited strong action potentials.

TABLE 2. — *Effect of Variations in Degree of Extension and in the Amount of Force Required to Produce Extension on the Appearance of Action Potentials in the Spastic Biceps.*

Degrees of extension	1.5	3.0	4.5	6.0
Grams				
Minimal to extend required distance	0	0	0	+
500	0	0	0	++
750	0	±	+	++
1000	0	0	++	++

Sample Protocol of One Experiment

0 no electromyographic activity.
± occasional transient motor unit potential.
+ motor unit potentials in approximately 50 per cent of the trials.
++ motor unit potentials in almost all trials.

In 12 experiments on 5 hemiplegic patients no electrical activity was noted on 1.5 per cent elbow extension with the minimal forces used in the above study. Further studies were done varying the rate of extension (increasing weights in pan) and the degree of extension. On the average (see protocol of experiment in Table 2) no action potentials could be elicited with 1.5 per cent of extension even with forces up to 1,000 gms. As the degree of extension increased, however, beyond 1.5 degrees C., electrical activity was noted more frequently on stretch. In general, the amount of activity increased with increase in degree and rate of extension.

Discussion

A method has been devised to determine the resistance offered by the spastic arm to extension by measuring the minimal force required to extend the elbow 1.5 degrees from an angle of 145 degrees. For the procedure used to be a valid one, it would have to detect differences in resistance or changes in resistance under conditions in which, from clinical or other evidence, such differences or changes are known to exist. Such a test could exist in comparing the normal and the spastic side, in studying the effect of brachial plexus block, and in determining the effect of the tonic neck reflexes.

Since the test clearly demonstrated the difference between the normal and spastic extremity (Figure 2), showing, in addition, that elbow extension became more difficult as the elbow angle increased, and since it was able to demonstrate the effect of brachial plexus block and change in head position, it was believed that it could also be used to study changes produced by therapeutic procedures.

The effect of head rotation away from the hemiplegic extremity corresponds with previous work on the decerebrate cat[23] and the hemiplegic patient.[24-27] Head rotation towards the affected side, which has been shown to produce elbow extension, produced no significant change in this study. This may have been due to the relative large extension (145 degrees) used in the initial position.

Results obtained by head flexion and extension, however, seem at first to contradict previously obtained data.[23-24] Brain[25] and Simon[26] found, however, that when the patient was in the sitting position, neck extension increased flexor tonus and neck flexion decreased it. Our findings are in agreement with these observations.

As far as the effect of therapeutic agents on resistance to passive extension is concerned, it is noted that only infra-red radiation at 14 inches and intravenous Myanesin® resulted in statistically significant decreases. Infra-red radiation at 14 inches produced a small, though consistent, average decrease in resistance to extension of 9 per cent. This was not, however, long lasting. Myanesin®, however, caused a greater decrease in resistance, and one which lasted for a longer period of time. We must emphasize that the failure of the other methods to reduce the resistance of the forearm to extension does not necessarily indicate therapeutic inadequacy.

Although the resting spastic muscle is electrically silent,[18] passive stretch has been found to elicit action potentials.[19-20] In view of this observation, it is of interest that, in this study, forces which were sufficient to detect differences between normal and spastic extremities in resistance to passive motion did not elicit any motor unit potentials. Further, this resistance could be increased by head rotation and extension without resulting in the appearance of motor unit action potentials. Yet, quite evidently, the increase in resistance is mediated by the peripheral nerves, since brachial plexus block resulted in an immediate decrease in this resistance.

This study provided no answer to the problem. It may be noted, however, that Gelfan and Bishop[28-29] have demonstrated submaximal contraction of muscle fibers on direct electrical stimulation and maximal contraction on mechanical stimulation, without the appearance of action potentials. These studies were on the muscle fibers of the retrolingual membrane of the frog.

In addition, it has been shown, by Kuffler and Gerard,[30] that, in the frog a small-nerve motor system to skeletal muscle is present, which can cause appreciable tension development in the muscle without motor unit potentials. Small slow potentials changes do, however, exist following stimulation of these small-nerves.

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[23] Magnus, R.: Some Results of Studies in the Physiology of Posture, Lancet 2:531, 585 (Sept. 11, Sept. 18) 1926.

[24] Walshe, F. M. R.: On Certain Tonic or Postural Reflexes in Hemiplegia, with Special Reference to the So-called "Associated Movements," Brain 46:1 (May) 1923.

[25] Brain, W. R.: On the Significance of the Flexor Posture of the Upper Limb in Hemiplegia, with an Account of a Quadrupedal Extensor Reflex, Brain 50:113 (June) 1927.

[26] Simons, A. von: Kopfhaltung und Muskeltonus, Zeitschr. f. d. ges. Neurol. u. Psychiat. 80:499, 1923.

[27] Yamshon, L. J.; Machek, O., and Covalt, D. A.: The Tonic Neck Reflex in the Hemiplegic, Arch. Phys. Med. 30:706 (Nov.) 1949.

[28] Gelfan, S., and Bishop, G. H.: Action Potentials from Single Muscle Fibers, Am. J. Physiol. 101:678 (Sept.) 1932.

[29] Gelfan, S., and Bishop, G. H.: Conducted Contractures Without Action Potentials in Single Muscle Fibers, Am. J. Physiol. 108:237 (Jan.) 1933.

[30] Kuffler, S. W., and Gerard, R. W.: The Small-Nerve Motor System to Skeletal Muscle, J. Neurophysiol. 10:383 (Nov.) 1947.

These findings merely suggest that, in other species, muscle tension can exist without the appearance of motor unit action potentials. Such observations are not directly transferable to man.

Summary

1. A method to measure quantitatively the degree of resistance offered by an extremity to passive motion has been presented.
2. This method is quantitatively sensitive to differences between the normal and spastic extremity at various degrees of elbow extension as well as to changes produced by the tonic neck reflexes and by brachial plexus block.
3. The effect of eight therapeutic agents on the resistance to passive motion was studied. Only two, near infra-red radiation at 14 inches and intravenous Mephenesin, produced statistically significant decreases in this resistance.
4. Electromyographic studies showed that increased resistance to extension in a spastic muscle could be demonstrated during degrees of extension which did not evoke action potentials. Similarly, changes in position of the head altered the resistance of the extremity to passive motion without producing action potentials.

Discussion

Dr. Bruce B. Grynbaum (New York, N. Y.): I would like to congratulate Drs. La Joie and Gersten on their most interesting presentation. The problem of muscle spasm is of great importance to the physiatrist in his clinical work and has many puzzles for the laboratory worker. The best examples of the controversy on this subject is that the authors carefully avoided the words "spasm" and "spasticity," substituting for them the terms "tightness." Naturally, we cannot speak of spasm or spasticity of normal muscles.

The lack of electromyographic activity was of great interest to me. The authors broach the question as to what degree the measurements were influenced by the elasticity of the muscles. The hemiplegic muscle is probably shorter than the normal muscle and at the same angle would be stretched more — sharp upgrade to terminal extension. The fact that the brachial plexus block affected the results only by 42 per cent should be noted; I should like to hear Dr. LaJoie comment on the possibility that the block decreased elasticity of the muscle and that the remaining 63 per cent of resistance was caused by stretch and tissue elasticity. On the other hand, the differences in measurements produced by neck flexion would favor a neuromotor mechanism. The effect of heat and Mephenesin (Myanesin®) might be either on motor function or elasticity.

I would suggest to the authors a following additional experiment in order to distinguish further between elasticity and motor activity:

1. Comparison of the results from use of larger angles of displacement, e. g., 30 or 40 degrees.
2. Comparison of the differences produced by changes in the speed of displacement.

Dr. LaJoie (closing): In regard to the question of resistance offered being due to elasticity, particularly at the increased angles of elbow extension, I mentioned that the angle course is 145 degrees and that the resistance dropped 47 per cent, and that 47 per cent in the cases we did represented an average, but that in some of the cases the resistance dropped below that of the normal extremity and in other cases it closely approached the resistance offered by normal extremities. We felt that by doing the block we had ruled out the possibility of resistance being due to contractures in the tissue or to elasticity change. As far as the difference in angle displacement and the speed of displacement are concerned, I didn't quite understand what Dr. Grynbaum meant. Did he ask if we studied the resistance at those different angles or the electro myogotic activity? (**Dr. Grynbaum** — Was the resistance measured at different angles of displacement?) **Dr. LaJoie** — No we did not study the resistance. We did study the electromyographic activity and we have stated that as the angle or the acceleration increased the electrical activity increased. The other question that came up was whether our electrodes picked up proper motor unit. This is certainly a serious question as related to this problem; we took many samples of each muscle, repeating the experiment over and over and we used coactional needles, single needle electrodes; we also used skin electrodes. Perhaps we haven't done enough sampling yet, I don't know.

STUDIES OF THE EFFECT OF MASSAGE ON THE FLOW OF LYMPH FROM THE FORELEG OF THE DOG *

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MINNEAPOLIS

The use of massage for its therapeutic effect is one of the oldest of prescribed treatments. However, as is true of many other forms of treatment, the use and value of massage has been based largely upon its clinical results, rather than upon objective physiological evidence of its effects as observed in scientific research. The scientific basis for the use of massage in circulatory disorders is not clearly understood. The benefits to the circulatoin of the blood, which were alleged by the older clinicians such as Hoffa[1] in 1900, Rosenthal[2] in 1910, and Pemberton[3] in 1930, have not been borne out by research. Nevertheless, in the hospital massage is observed to hasten healing in areas of impaired circulation. It has been shown in the clinic that massage decreases local blood stasis and reduces edema.[3] These effects have been attributed to an increased fluid and food exchange, with improved cellular metabolism.[3] It was believed that this was accomplished by the increased external pressure on the tissues and a stripping of the blood and lymphatic vessels of their contents.[2]

Recent research has not always supported the clinical claims made for massage. Wolfson[4] in 1931 found, by cannulation of the femoral vein, that during a ten minute period of massage the blood flow increased rapidly. As soon as massage ceased, the flow decreased to the control or less than control rate of flow. There was no prolonged effect on blood flow by massage. Wakim and others[5] in 1949 found, by measurements with a plethysmograph, that there was no consistent or significant increase in total blood flow after deep stroking or kneading massage of the extremities. Studies done by Drinker and Field[6] in 1933, and by Drinker and Yoffey[7] in 1941, on lymphatic flow have shown that upon initiation of massage there is a rapid flow of lymph, which decreases in rate over a ten minute period and ceases almost immediately when the massage is discontinued. From these studies it might be assumed that massage does not have a significant effect on circulation or on cellular metabolism. If this assumption were valid the therapeutic value would not justify the use of massage to aid circulation.

However, clinical experience, although harder to control than laboratory

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* Abridgment of a thesis submitted by Margaret P. Ladd to the faculty of the Graduate School, University of Minnesota, in partial fulfillment of the requirements for the degree of Master of Science in Physical Therapy.

* Read at the Twenty-Ninth Annual Session of the American Congress of Physical Medicine, Denver, Colorado, Sept. 5, 1951.

1. Hoffa, A. J.: Technik der Massage, Germany, Stuttgart. F. Enke, 1900. Trans. Bohm and Gould, Philadelphia, W. B. Saunders Company, 1913.

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4. Wolfson, K. J.: Studies on Effect of Physical Therapeutic Procedures on Function and Structure, J. A. M. A. 96:2019 (June 13) 1931.

5. Wakim, K. G.; Martin, G. M.; Terrier, J. C.; Elkins, E. C., and Krusen, F. H.: Effects of Massage on the Circulation in Normal and Paralyzed Extremities, Arch. Phys. Med. 30:135, 1949.

6. Drinker, C. K., and Field, M. E.: Lymphatics, Lymph, and Tissue Fluid, Williams and Wilkins Company, Baltimore, 1933.

7. Drinker, C. K., and Yoffey, J. M.: Lymphatics, Lymph, and Lymphoid Tissue: Their Physiological and Clinical Significance, Cambridge, Harvard University Press, 1941.

experiments, affords considerable evidence that massage does improve the transport of food and oxygen to the cell and thereby does increase the vitality of the cell. Varicose ulcers produced by venous congestion and edema heal faster when aided by massage. Decubital ulcers and cicatrices of wounds and burns also respond faster when massage is used. Edema from any cause responds to a skillful massage with at least transitory relief. Post-traumatic edema may be decreased by massage and brawny edema minimized. The patient who is inactive because of paralysis or prolonged immobilization develops venous stasis and edema. Massage, employed as a partial substitute for motion in this instance, decreases the stasis of blood, decreases edema, and improves the appearance of the extremity and the comfort of the patient. These are clinical experiments which have been demonstrated repeatedly. The basis of the beneficial effects needs elucidation.

The purpose of this research was to seek the basis for the usefulness of massage in vascular disturbances. The effect of massage on tissue fluid movement and lymph production was studied. Comparison was made of the effects of massage on lymph flow with those of two other common therapeutic modalities — passive motion and muscular contraction as simulated by electrical stimulation.

Methods

Seventeen dogs were used in this study. They were chosen at random from the kennel of stock animals. Anesthesia was established by intravenous administration of pentobarbital sodium, 33 mg/kg of body weight. DuPont's Sky Blue Dye, 1.5 — 2 per cent, was injected subcutaneously between the digits of the forepaw in order to stain the lymph and facilitate cannulation.

A ten centimeter incision was made in the antrolateral aspect of the neck, medial to the lymph gland which collects lymph primarily from the foreleg and the shoulder. The largest of the dye-filled efferent lymph channels from this gland was located by blunt dissection into the deeper structures of the neck. The channel was cannulated by using polyethylene tubing. Lymph was collected in test tubes in which one drop of heparin solution had been placed to prevent clotting.

Each experiment consisted of a sequence of three procedures: massage, passive motion, and electrical stimulation. There was a ten minute equilibrating period before any procedure of the experiment was begun. Each procedure was applied for a ten minute period and was followed by a ten minute control period of complete rest. The volume of lymph collected during each ten minute period, procedure or rest, was measured in a ten cubic centimeter graduate. The experiment was repeated two to four times on each dog. The sequence of procedures was rotated from dog to dog.

For electrical stimulation of the muscles of the leg an electrode of tin, covered with a pad saturated with normal saline, was placed in contact with the skin of the lumbar area where the hair had been clipped. A small electrode of tin measuring 1 x 15 cm., protected on one side by plastic tape, was passed around the brachial plexus. A sixty cycle sinusoidal current was used to stimulate the motor nerves to both the flexor and the extensor muscles of the forelimb intermittently. This gave a static muscular contraction of the entire limb. The duration of stimulation was three seconds and the rest period was two seconds. The effective current for stimulating the brachial plexus was calculated to be 0.05 to 0.7 milliamperes.

Passive motion consisted of alternate flexion and extension of the paw, elbow, and shoulder, following the rhythmic patterns of slow motion running. Massage was carried out, using a modified Hoffa technique. This consisted of three long introductory strokes running from the tip of the paw to and including the shoulder, followed by ten strokes of effleurage and ten of petrissage, with friction at the joints, progressing from the paw to the shoulder by muscle groups. All strokes were applied in a centripetal manner.

Results

The collection of lymph in these experiments was only semi-quantitative. Only one lymphatic channel of the several that drain the foreleg was cannulated. There was no way of knowing what per cent of the total lymph flow from the foreleg was obtained. However, the area drained from the foreleg of each dog remained the same throughout the various procedures.

Table 1. — *Comparison of the Effectiveness of Massage, Passive Motion, and Electrical Stimulation in Causing Lymph Flow from the Foreleg of the Dog (15 Animals).*

Procedure	Number of Experiments	Mean Flow (cc./10 Min.)	Standard Deviation*	Standard Error†	Probability‡
Control	156	0.16	±.13	....	....
Massage	52	2.81	±1.87	±0.26	<.001
Passive Motion	52	1.78	±1.35	±0.19	<.001
Electrical Stimulation	52	0.75	±0.90	±0.13	<.100

* Standard deviation of the distribution. In the case of electrical stimulation this figure exceeds the mean as the result of skewness.

† Standard error of the mean.

‡ ....Probability: The figures in this column are the probability that the difference between test and contratest (control) would arise as an accident of sampling.

The value of p (probability that the observed difference between test and contratest would arise as an accident of sampling) was also computed for the differences, (1) between massage and electrical stimulation, (2) between massage and passive motion, and (3) between passive motion and electrical stimulation, and was found to be less than 0.001 in all three cases.

A study made of fifteen dogs as a group showed that the rest period between procedures was an adequate control period (Table 1). The lymph flow during the quiet control period was negligible, averaging 0.162 cc. per ten minutes. A drop or two of lymph usually flowed from the polyethylene tube at the beginning of the control period following activity, and then there was cessation of flow through the remainder of the control period. Activity of any type — massage, passive motion, or electrical stimulation — was accompanied by an increase in lymph flow over that of the control period.

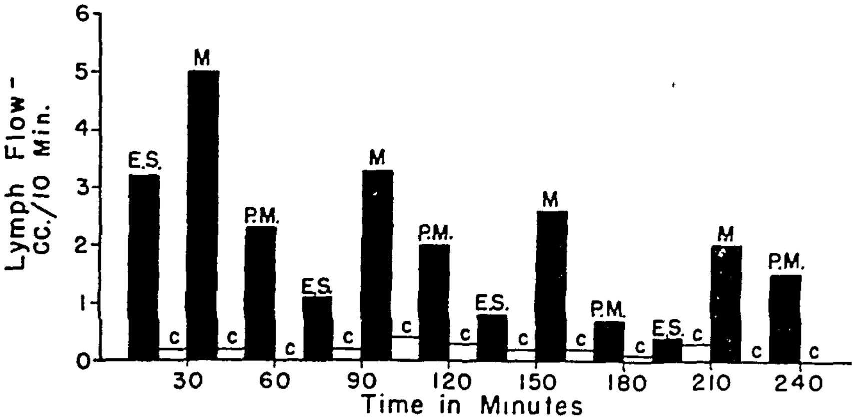

Fig. 1. — Comparison of the effects of massage (M), electrical stimulation (ES), and passive motion (PM) on lymph flow from the forelimb of an anesthetized dog. The procedures were administered in sequence for ten minute periods as indicated, alternated with ten minute control periods (C) of complete inactivity. This experiment is typical of the relative effectiveness of the three procedures for producing lymph.

Massage, as applied in this study, produced the greatest volume of lymph flow. Figure 1 illustrates a typical experiment with the sequence of procedures alternating with quiet control periods. There was usually a progressive decline in the rate of lymph flow throughout the experiment as illustrated here. In some experiments, after the first sequence of procedures the rates of flow would remain fairly constant for each procedure. Massage usually produced the greatest amount of lymph, followed by passive motion; and electrical stimulation produced the least. There was considerable variation of lymph flow from one dog to the next. Likewise the first sequence of procedure on each dog and usually the first procedure of that sequence produced a much greater lymph flow than any subsequent procedure. Therefore the variability of lymph flow made it impossible to establish the significance of the procedures statistically on some animals. On a series of fifteen dogs similar experiments were run and a statistical study of the effectiveness of massage, passive motion, and electrical stimulation was made (Table 1). Massage caused a mean lymph flow of 2.81 ± 1.87 cc. per 10 minute period. Passive motion produced a lymph flow of 1.78 ± 1.35 cc. per 10 minute period. Electrical stimulation was least effective and showed the greatest relative variability, producing 0.75 ± 0.90 cc. of lymph per 10 minute period.

TABLE 2. — *Analysis of the Rate of Lymph Flow from the Foreleg of the Dogs During Massage, Passive Motion, or Electrical Stimulation When the First Sequence of Procedures Was Excluded. Storage of Water in the Extremity Prior to the Experiment Made the Lymph Flow During the First Sequence of Procedures Much Greater Than During Subsequent Procedures.* (*15 Animals.*)

Procedure	Number of Experiments	Mean Flow (cc./10 Min.)	Standard Deviation*	Standard Error†	Probability‡
Control	111	.15	±.08	....	....
Massage	37	2.26	±.70	±.11	<.001
Passive Motion	37	1.41	±.94	±.16	<.001
Electrical Stimulation	37	.55	±.43	±.07	<.001

* Standard deviation of the distribution.
† Standard error of the mean.
‡ Probability that the difference between test and contratest would arise as an accident of sampling.

Because the first sequence of procedures always produced a much greater lymph flow than subsequent procedures, the data on the series of 15 dogs was reanalyzed, excluding the first sequence on each dog (Table 2). This decreased the factor of storage of tissue fluid before the experiment began. Massage still produced a lymph flow significantly greater than the other procedures, 2.26 ± 0.70 cc. per 10 minute period. Passive motion, 1.41 ± 0.94 cc. per 10 minute period, produced significantly more lymph than electrical stimulation, 0.55 ± 0.43 cc. per 10 minute period.

Hydration of the animal has been reported to be a factor influencing rate of lymph flow.[8] All dogs in this series had been given water ad libitum prior to the experiment. There was no other control of hydration from animal to animal. One animal studied appeared to be rather dehydrated. After three sequences of procedures, Ringer's solution was infused into the right jugular vein at 10 cc. per minute (Figure 2). This infusion produced a pronounced increase of lymph flow with each of the procedures studied, although there was no flow during the control periods. This dog was not included in the study group of 15 dogs.

In one experiment it was possible to observe the effect of prolonged shivering on lymph flow. This animal differed from those in the large series in that the common junction of the thoracic duct and the lymphatic to the foreleg was cannulated. Shivering is a form of muscular activity involving alternating contraction of agonists and antagonists with considerable motion over a short range. Shivering was found to be very effective in promoting

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[8] (a) McCarrell, J. D.: The Influence of Various Factors in the Flow and the Protein Content of Cervical Lymph as Established by a New Quantitative Method for the Measurement of Lymph Flow. Thesis for a Ph.D. degree as submitted to Radcliffe College. (b) McCarrell, J. D.: Effect of Warm and Cold Nasopharyngeal Irrigation on Cervical Lymph Flow, Am. J. Physiol. 128:349, 1941.

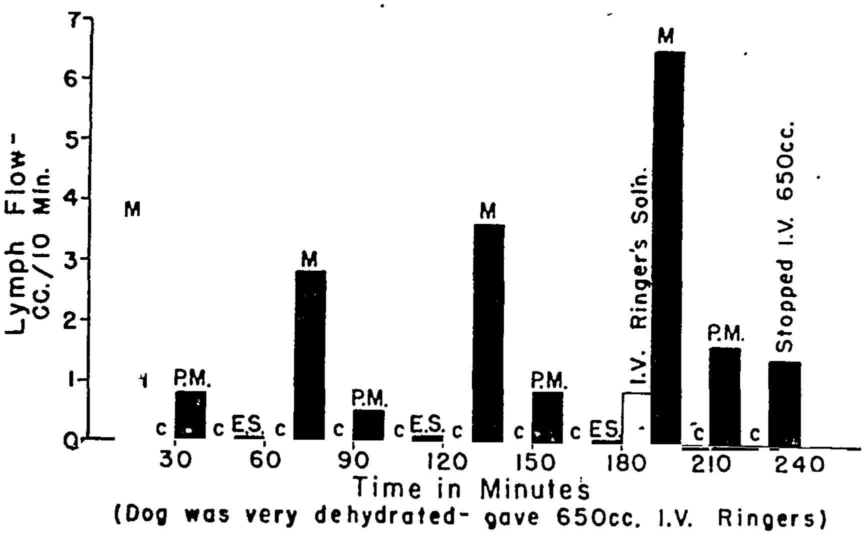

Fig. 2. — The effect of hydration on rate of lymph flow from the forelimb of a dog. After a sequence of massage, passive motion, and electrical stimulation. Ringer's solution was injected into the right external jugular vein at the rate of 10 cc. per minute. During the infusion the lymph flow increased during the procedures but not during the quiet control periods.

the flow of lymph (Figure 3). After the initial procedure — massage — the dog began to shiver and for the next seventy minutes the lymph flow produced by shivering during the "control" periods was in the same range as that produced during passive motion or massage. At ninety minutes shivering was inhibited by warming the animal with a lamp, and the lymph flow decreased. At 130 minutes the animal was cooled again. Violent shivering now caused a rapid flow of lymph, 5.6 cc. in a 10 minute period.

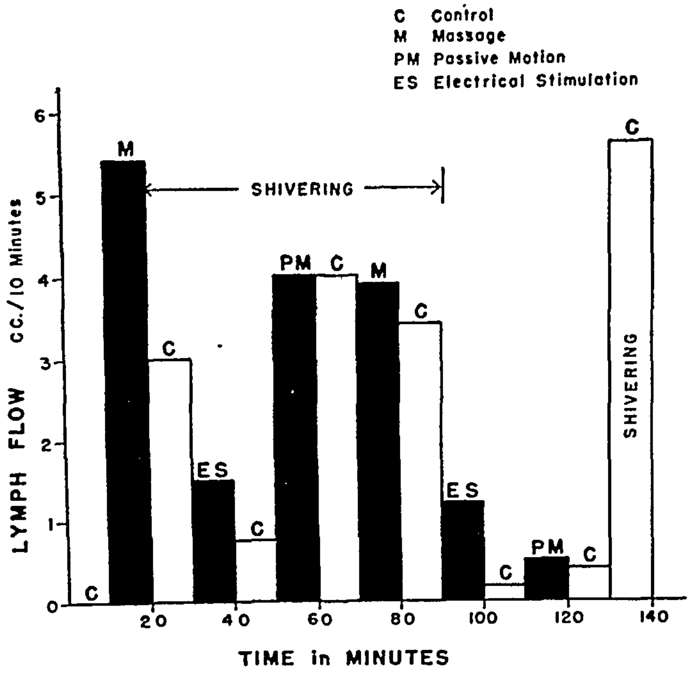

Fig. 3. — The effect of shivering on the rate of lymph flow. The junction of the thoracic duct and the foreleg lymphatic was cannulated. Shivering increased progressively from 20 minutes to 90 minutes. At 90 minutes the animal was heated with a lamp and shivering was inhibited. At 130 minutes the lamp was turned off and violent shivering occurred.

Comment

This study was undertaken to attempt evaluation of massage as a therapeutic tool in promoting lymph flow and decreasing interstitial edema. There are certain inherent difficulties in studying lymph flow. Lymph channels are small, numerous, and irregular in position. It is not possible, as in studying circulation of the blood, to cannulate one large vessel and measure flow from a leg. It is not even certain that from one animal to the next the same lymphatic vessels will occur in the same location with drainage from the same area. Nevertheless, it was possible to get a semi-quantitative measure of lymphatic flow from the foreleg of the dog in response to various procedures studied. For each animal it is probable that the area of lymphatic drainage remained constant throughout the experiment, so that one procedure may be compared to the others. However, from animal to animal the area of the forelimb from which lymph was collected may have varied considerably. Injection of dye into the forepaw assured that the lymphatic vessel cannulated collected a proportion of the lymphatic flow from the paw. Usually only one dye-filled lymphatic channel was seen leaving the large lymph node above the shoulder. This would support the belief that most of the lymphatic flow from the paw was collected through the cannulated lymphatic vessel.

Lymph is formed from extravascular fluid and contains the same compounds as found in extravascular fluid: water, electrolytes, protein, and metabolites. The lymphatic capillaries are incomplete endothelial tubes originating in the tissue spaces. Tissue fluid flows passively from the extravascular spaces into these incomplete lymphatic capillaries, depending on the pressure gradient. The direction of the pressure gradient determines the direction of flow. Protein can move as freely in this gradient as can smaller crystalloids. As fluid flows along the lymphatic capillary, and walls pass by transition to complete endothelial tubules and later to endothelium surrounded by connective tissue when the lymphatic collecting vessels are reached. In the lymphatic vessels, endothelial valves are found which prevent back flow of fluid; consequently, a one-way conduction system is set up. Water and crystalloids will filter through the walls of the lymphatic tubules if the intra-lymphatic pressure is raised, while protein is retained. Because of this, the protein content of the lymphatics rises slowly from the lymphatic capillaries to the large lymphatic vessels. The rate of flow of lymph along a lymphatic vessel depends on intermittent external pressure on the vessel, producing a pressure gradient. Therefore, the rate of lymph flow will be dependent partially on the rate of alternation of external pressure on the tissue spaces and lymphatics, and the direction of progression of the pressure gradient. Because the network of lymphatics is very extensive, the direction or application of pressure is a less important factor than the rate of alternation of pressure. Nevertheless, it appears that a pressure progressing centripetally along a lymphatic vessel will strip successive compartments in the lymphatics and cause a more rapid rate of flow than irregularly applied pressure.

Carefully applied massage appears to be one of the most favorable means of exerting the external pressure necessary to cause lymph to flow. Progression of the pressure gradient from the tissue spaces to the lymphatic capillaries and then progressively along the lymphatics effectively strips the lymph from the vessels. Although this theoretical value of massage has been recognized for many years, the relative effectiveness of massage, passive motion, and active muscular contraction has been questioned. It was interesting therefore, to observe that under the conditions of the experiment there was a demonstrable difference in the rate of lymph flow when massage was used as a means of promoting flow as compared to passive motion or muscular contraction. That there would be this clear cut advantage of massage over other means of producing lymph flow had not been anticipated when this series of experiments were begun. Nevertheless, the differences in the effect of massage, passive motion, and electrical stimulation in causing muscular contraction, on this series of dogs, was unmistakable.

It has been recognized for many years that muscular contraction is an excellent way to cause lymph to flow. White, Drinker, and Field[9] showed that lymph flowed from the paw of the dog during walking or running at a relatively rapid rate. The action of "auto-massage" on the lymphatics by the muscles is recognized clinically as being the normal mechanism for promoting the flow of lymph. Clinically the question can be raised, "Is the artificial method of promoting lymph flow by massage as effective as normal 'auto-massage'?" It is obvious that the rate of lymph flow will vary with the type of muscular activity. Slow or sustained contractions of muscles will have a far different influence than repeated contractions of short duration. Likewise, muscle setting, in which there is little movement of the joint or shortening of the muscle, may have an entirely different effect than full contraction and extension of the muscle, which would exert considerable lateral pressure on the lymphatics. In addition, the motion of the joint with stretching and compression of the periarticular soft tissue will be a factor in the various types of muscular activity. It was obvious from this study that the isometric type of contraction was not nearly as effective as the muscular activity during shivering where there is alternating contraction and relaxation of the muscle, even through a relatively short range. Other types of muscular activity might be found to be still more effective in promoting the flow of lymph. Nevertheless, it is of interest to observe that isometric muscular contractions were not as effective in promoting lymph flow as was a systematic manual massage.

The usefulness of massage, observed clinically in circulatory diseases, may have as its basis the effects demonstrated here. The total circulation from a functional point of view must include the transportation of food materials from the alimentary tract and oxygen from the lungs through the blood vessels, across the capillary wall, through the intercellular space, and to the cell. Likewise, metabolic products must be returned from the cell, across the intercelluar space, to the capillary, and back through the blood circulation to the excretory organs. Because of its discreteness, we often are inclined to think of the hemal circulation as the total circulation and end our considerations of transport of materials at the capillary. In the metabolic circulation, the hemal circulation constitutes only a part of the supply system. When there is a disturbance in the extravascular circulation, particularly when there is edema, true metabolic circulation time to the cell is greatly prolonged. Under normal circumstances, the extravascular distance from the capillary to the cell is relatively small and diffusion can occur across it at a rapid rate. If there is increased extravascular fluid, the distance from capillary to cell is increased, and diffusion time for materials increases as the square of the distance. Consequently, edema becomes an important factor in slowing down metabolic circulation. As the edema increases, the rate of transport of food and oxygen to the cell becomes increasingly slower and less adequate to meet the metabolic demands. At some point the edema will become so great that normal metabolism is not possible. Then atrophy or death and destruction of the cell must occur. When disturbances of the hemal circulation are added to disturbances of the extravascular circulation, this circulatory insufficiency is aggravated.

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[9] White, J. C.; Drinker, C. K., and Field, M. D.. On the Protein Content of Normal Flow of Lymph from the Foot of the Dog, Am. J. Physiol. 103:34, 1933.

The lymphatic system plays an important role in maintaining the balance of circulatory exchange across the capillary wall. Although the total filtration and reabsorption of water at the capillary is great, the net exchange is relatively small. However, if there is a persistent excess of filtration over reabsorption, edema will occur. Likewise, the slow leak of proteins through the capillary wall will raise the protein concentration in the tissue spaces to that of the plasma if there is no mechanism for removal of these plasma proteins. Consequently, the lymphatic circulation plays an important role in draining off excess fluid filtered through the capillary wall and in providing a path for removal of proteins which have leaked across the capillary membrane. Under conditions in which the lymphatic circulation plays its normal role, the total circulation is adequate to meet the metabolic demands. On the other hand, if there is obstruction of the lymphatic circulation or if no external forces are applied to produce a flow of lymph, there is lymphatic stasis with progressive accumulation of water, crystalloids, and protein in the tissue spaces. Under these circumstances, the impairment of cellular metabolism, with which we are familiar in the clinic, occurs. Promotion of lymphatic flow by external mechanical pressures will decrease the accumulated tissue fluid, shorten the distance for diffusion from capillary to cell, improve cellular metabolism, and allow healing to occur at a more normal rate. The effect of massage on lymph flow may explain its value in conditions of stasis edema, with or without impairment of the hemal circulation. Indolent ulcers, stasis ulcers, and decubital ulcers all occur under conditions in which the metabolic circulation is impaired either in its hemal component or its extravascular component or both. Disturbances both within and without the hemal circulation may be of such magnitude that they prevent normal cell metabolism and lead to ulcer formation. For effective healing to occur, it is necessary to correct the deficiency in the metabolic circulation. Where the problem is one primarily of an extravascular disturbance with an increased distance for diffusion from the capillary to the cell, measures which are aimed at increasing circulation through the capillaries will not be completely effective in relieving the condition. On the other hand, simple measures which are effective in decreasing edema and promoting lymph flow will increase the transport of food to the cells and metabolites from the cells and allow healing to occur at a rapid rate. The demonstration here that massage is an effective method of promoting lymph flow and thereby decreasing interstitial fluid and increasing extravascular transport emphasizes the importance of its use clinically in cases of circulatory or metabolic disturbances with edema.

Summary

Studies were carried out on dogs of the effectiveness of systematic massage, passive motion, and electrical stimulation, producing simultaneous contraction of agonist and antagonist muscles, on the rate of lymph flow from the forelimb. A polyethylene tubing cannula was inserted into a large lymphatic vessel above the shoulder of the dog, and lymph was collected during control periods and the listed procedures. On a series of fifteen dogs, all three procedures were found to greatly increase lymph flow above that of the control period. Massage was found to be significantly more effective than either passive motion or electrical stimulation in this series of animals. Alternating contraction of flexors and extensors as demonstrated by shivering was found to be a very effective method of promoting lymph flow. Saline infusion increased the rate of production of lymph. The clinical implication of these procedures was discussed.

Discussion

Dr. Frederic J. Kottke (Minneapolis, Minnesota): May I make one comment to emphasize the discussion? This session this morning is very interesting, because in his introduction Dr. Behrend pinpointed the problem that was raised by the Mayo Clinic group when they pointed out that there was essentially no increase in the flow of blood when we massaged an extremity.

Actually, what they studied, if we can diagram it, was the circulation of blood through the vein, and consequently the circulation through the capillary and the artery. They found that massage as carried on in American practice did not increase materially the flow of blood in this area. A number of people said, therefore, that "massage has no mechanical effect on circulation, period; we will not use it any more." Actually, that has been accepted in some places.

One thing that was forgotten, and the thing that stimulated us in beginning this experiment, was this comment that massage has no effect on circulation. We forget that the circulation of the blood — the circulation, for instance, described by Harvey — is not the true metabolic circulation. We have a cell out here somewhere that requires oxygen, glucose, and other food products which produce metabolites, and these materials come down through the blood to the capillary. Then they cross the capillary membrane by filtration, and must diffuse across this interstitial space to the cell.

If this space is increased the diffusion time is increased. Usually this space is relatively small, and diffusion across this space is practically as rapid as the circulation of the material to the capillary, so we have no disturbance.

But as the intercellular space is doubled, the diffusion time is increased as the square of the distance. Therefore, if we double this space we increase the time necessary for transporting the materials by 4. If we treble it we increase it by 9, and so on.

It is very obvious that when we have edema there is marked impairment of the circulation outside of the blood from the capillary to the cell; thus when we have conditions of edema we find clinically, by observation, that there is an impaired metabolism, and that that edematous tissue breaks down more readily than the nonedematous tissue.

We have a mechanism for a reserve mechanism to carry off this edema fluid if it cannot go back through the vein, and that is the lymphatics. We were studying today the effect of these methods on moving extracellular, extravascular fluid into the lymphatics and through the lymphatics, and I was actually very much surprised to find out that massage actually will promote lymph flow better than passive motion or electrical stimulation that causes muscle contraction.

I am sure I can produce types of muscular contraction that will be as effective as massage; but we were pleasantly surprised to find out how effective massage was in promoting lymph flow, which means the removal of the fluid and the decrease of the extravascular space so that the total time of metabolic circulation (if we may use that term for lack of a better one — the movement of materials through the blood, through the extracellular space, back to the blood and out through the venous circulation) is actually decreased following massage in conditions when we have edema or increased tissue fluid.

Dr. L. B. Newman (Hines, Illinois): I would like to raise several questions with reference to the research done by the essayists. Was the circulation in the dogs normal? If not, was any edema produced before the studies were initiated? Was the resulting data secured only in dogs with normal circulation, or was some study done on the effect of massage in pathologic conditions such as fractures, neuromuscular involvement, etc.?

Margaret P. Ladd (Minneapolis, Minnesota): They were normal dogs, as far as we could tell. They appeared normal; their blood pressure was normal; their color was normal, and they were not "picked" in any way. They were simply taken from the kennel as the caretaker gave them to us. All of them weighed from 25 to 50 pounds. We did not give them any additional fluid.

Newman: Was there any edema in the extremity of any of these dogs?

Ladd: No. We used between 5 and 10 cc. of dye in the paw about 1 hour before tests were begun. There was no appreciable edema that we noticed.

VOCATIONAL TESTING IN EDUCATIONAL THERAPY *

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and
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Introduction

The educational therapy section at the Chillicothe hospital is conducting a vocational testing program which appears to be performing a definite service for the veteran. In addition to assisting the ex-GI in the selection of a suitable vocation, the testing program helps to integrate activities of the different departments which contribute to his rehabilitation. By doing this, the program promises to be another means of speeding up treatment and getting the veteran back on his feet as an effective member of society as soon as possible.

For the past two years the educational therapy section has been interviewing, testing, and submitting vocational interest reports on incoming veterans. Thus far over 600 veterans have been given occupational interest inventories.[1] Those who took the inventories ranged in ages from twenty-one to sixty-six. None was excluded because of type of diagnosis. Those who did not take the inventories did not desire to take them, or were absent from the ward and could not easily be contacted when the inventories were given. The group which took the inventories was composed of all types of male neuropsychiatric patients.

Theoretical Implications

To help the veteran to help himself, so that he may become a self-supporting member of society, is the underlying purpose of the testing program. In attempting to accomplish this purpose, the educational therapist is confronted by a number of problems which are familiar to those who have worked with the mentally ill.

One of the chief problems is that of getting the patient to make a realistic appraisal of his occupational potentialities. Although many patients manifest interest in constructing vocational plans, their plans are often nebulous and impracticable. Instead of pointing to occupational adjustment after release, their objectives are often indices of continued maladjustment.

Some aspire to goals beyond their capacity. Here, for example, is a patient of low-average intelligence who desires to become a lawyer. Here is another who is anxious to work as a special agent for the FBI. Another is convinced that he can contribute to his country's welfare by helping Mr. Einstein create an H-bomb.

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* Reviewed in the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the authors are the result of their own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

[1] The instruments used in this exploratory study of the vocational interests of male neuropsychiatric veterans were the intermediate and advanced series of the *Occupational Interest Inventory* devised by Edwin A. Lee and Louis P. Thorpe, California Test Bureau, Los Angeles, California, 1943.

The educational therapist cooperates with the vocational rehabilitation and educational advisers in attempting to substitute habits of rational thinking for habits of wishful thinking. Slowly the patient may be led to see that more good things in life can be secured from pursuing suitable objectives than from yearning for the impossible. Slowly he may come to see that as a member of society his social and economic effectiveness will depend to a considerable extent upon his wishful thinking's being supplanted by vocational plans that can be translated into practice.

In contrast to the patient who aspires to goals beyond his capacity, there is the individual who seemingly has no aspirations at all. The emotionally depressed patient often falls into this category. He often underestimates his ability, believing himself to be wholly worthless. Others, having retreated from reality, say that they are not interested in any type of work, that they merely wish to be left alone. Some, of course, admit that work has its good points but insist that they are so discriminated against by society that their chances of securing employment are nil.

It is the problem of the educational therapist to assist in altering such indifferent and negative ideas and to stimulate development of more positive attitudes. To motivate patients, to get them to take an interest in their vocational future, special appeals often have to be made; for many patients do not possess normal drives to action. Some have been disappointed and frustrated to a point where one thing appears as good as another — or where everything appears equally futile. But even for these there are possible sources of motivation, which the competent therapist is ever on the alert to discover.

Administering the Test

Shortly after a veteran is admitted to the hospital, he is interviewed by an educational therapist. He is encouraged to talk about his occupational experiences, about the problems he has encountered in his work, and about his vocational plans and ultimate objectives.

He is then invited to take an occupational interest inventory, the purposes of which are fully explained to him. He is told that it will help him to gain a clearer understanding of the type of occupation from which it is possible for him to achieve the most satisfaction. He is told that the results of the completed inventory will help the physician and the physical medicine rehabilitation chief to plan an individualized hospital program that is in line with his occupational interests. He is told that this information also will assist the different therapists in placing him in suitable activities as quickly as possible. He is told that the vocational rehabilitation and education advisers often use the inventory data in securing the approval for on-the-job training and in placing veterans in appropriate occupations at which they can earn a living after being discharged from the hospital.

Some veterans, of course, are not sufficiently in contact with reality to understand or to appreciate the use of the inventory. Some, who have only a partial understanding of its purpose, object on the ground that they have already been tested enough, or that such devices are just so much "bunk." Some are suspicious of the purpose for which the inventory is to be used, declining to take it for fear that the results will be used to keep them incarcerated.

No forceful tactics are employed to persuade the veteran to take the inventory. It must be taken voluntarily to achieve the most valid results, and to represent the patient's genuine interests.

Few of the veterans who have thus far taken the inventory have expressed disagreement with the findings. Some, as might be expected, have told the therapist: "The test tells me nothing I didn't know. I knew what my interests were before I took it." Others, however, seem to feel that the inventory has assisted them in clarification of their interests. Many seem to share the view expressed by one veteran: "I've been all bewildered and confused; but this sort of thing helps me to gain a clearer idea of what I want to do in life."

In some cases the findings tend to enhance the patient's self-esteem. Seeing the test results, he feels not only that he has discovered specific practical interests, but that he has had an active hand in their definition and organization. He feels that he, as an individual, has accomplished something toward the integration of his own personality. This gives him a measure of confidence. With the help of the therapist, he can see that further accomplishments are possible.

The therapist attempts to make clear to the veteran that interest is only one of several factors to be considered in vocational planning. He is told that data from the inventory should be supplemented by information from other sources. It is emphasized that his general physical condition should be considered; that specific aptitudes should be taken into account; that educational background and the possibilities for further training should not be overlooked; and further that in choosing a vocation it is well to consider the opportunities for employment as well as interest in the work.

Importance of Early Testing

The value of the testing program depends to a large extent upon the therapist's interviewing and testing the veteran *soon after he is admitted to the hospital.* There are advantages in getting the treatment program underway as soon as possible. When the veteran arrives, he is in an unfamiliar situation. The first impression he forms of the hospital is likely to be a lasting one. To secure from him the maximum cooperation, he must be shown when he first arrives that his new abode is not a prison but a hospital. To get the veteran into a frame of mind receptive to the idea of treatment, he must be shown from the start that he is here to be helped — not only physically but also in regard to social, educational, and vocational problems, which are often at the root of his troubles.

Many veterans would probably not receive the appropriate therapy, or their treatment would be indefinitely postponed, if they were not interviewed soon after admission. Some, feeling that they are deriving no benefit from hospitalization, check out against medical advice. Others simply go "absent without leave." Many of these who leave after a few weeks will later apply for readmission or will be returned by court order. Additional expense, as well as delay in rehabilitation, results from their having failed to remain at the hospital until maximum benefits were attained.

The educational testing program, in conjunction with the other physical medicine rehabilitation activities, helps the veteran to realize that he is being assisted toward the desired goal. This realization promotes greater cooperation between the veteran and the hospital staff, thus shortening the total time and reducing the expense of rehabilitation.

Another advantage in early interviewing and testing is that this procedure enables the therapist to secure information which can be used to advantage during the early stages of the rehabilitation program. Within a day or two after a veteran arrives, the information is typed and sent to the physician who is in charge of the veteran's treatment. Receiving the report before the patient leaves the admission building, the ward physician has an opportunity to look it over prior to interviewing the patient. This practice assists the physician in gaining a more thorough understanding of the veteran's problems. It also assists in screening out for immediate treatment the veterans most in need of attention.

Copies of the report are sent to the physical medicine rehabilitation chief and to the vocational rehabilitation and education adviser. Another copy is retained in the education section. Until more complete information from other sources has been compiled in the veteran's folder, this report serves a definite need. During the first few weeks of the veteran's treatment it is often the only source of useful information conveniently accessible to all personnel who are concerned with planning and carrying out the rehabilitation program.

The report, in addition to including a summary of the inventory findings, contains a brief statement of the veteran's educational background, his vocational experience, his plans and objectives and a description of any outstanding problems which he has had in regard to occupational adjustment. The interviewer gives his general impression of the patient, describing the extent to which the patient was cooperative and indicating his general attitude. Suggestions are also made as to activities in which the patient might be interested.

These reports, usually not over a page in length, enable hospital personnel to become better acquainted with the veteran's problems and interests, an understanding of which is requisite in placing the veteran in suitable activities as quickly as possible. This procedure reduces to a minimum the lethargy and resulting deterioration commonly experienced during periods of inactivity.

At the suggestion of a ward physician, the report has been extended to include a paragraph concerning the patient's interpretation of his own difficulties. It was suggested that we include information which might indicate the degree of insight possessed by the patient, or which might have diagnostic value.

Occasionally the patient discusses with the therapist certain important problems which he withholds from the physician. Such information, as nearly as possible in the patient's own words, is included in the report and often helps the physician to gain a broader understanding of the veteran's difficulties.

Apart from whatever use the inventory may have as a device for revealing vocational interests, it possesses value as an instrument for establishing rapport and drawing out the patient. It is one method of inducing the veteran to talk about his preferences, his experiences, his problems. While discussing his work, he often reveals information about his mental condition which he would not divulge if questioned directly on the subject.

This information, gained from a non-medical interview, may be of value to the physician. The vocational problems which the patient discloses are often indicative of deeper and more pervasive problems. He sometimes attempts to cover up his main problems by exaggerating his vocational difficulties. Such exaggerations provide the physician with clues as to the real nature of the patient's difficulties.

Then, too, while the patient is discussing his vocational problems, he not infrequently comes to observe his own difficulties more objectively. By talking about his problems he is able to get them out into the open where, to some extent, he can see them as other people do. In doing this he may discover that the deeper and more durable satisfactions of life are not to be found in infantilism and escape from growth but in development through education toward social and vocational adjustment.

Inasmuch as the vocational testing program is only a part of the treatment received by the veteran, it would be difficult to determine precisely what it contributes to total rehabilitation. Yet it is encouraging to note that practically all the veterans seem to appreciate having an opportunity to discuss their vocational problems and to take the occupational inventory. And it is encouraging to note that the ward physicians have commended the educational therapy section for the results thus far attained.

Results

Of 600 veterans who have taken the occupational interest inventories, 400 have taken the intermediate form and 200 the advanced form. The intermediate form was given to those who had not completed high school, the advanced form to those who had. A comparison of the results obtained from the two groups revealed no significant differences except a higher level of interest in the advanced group. That is, the high school graduates tended to be more ambitious than those who had not graduated from high school.

Significant differences are revealed when the results obtained by the neuropsychiatric veterans are compared with those obtained by non-hospitalized veterans.[2] The former attained higher scores in the personal-social and natural fields than did any of the other veteran groups. The personal-social field includes interests which involve association with or service to individuals or groups of individuals — such as domestic service, social service, teaching, law and law enforcement, and health and medical service. The natural field includes agriculture and work related to utilization and protection of natural resources. In the field of science the neuropsychiatric veterans attained the lowest score. They also had a lower level of interest than any of the other groups, indicating a tendency to prefer jobs of a simple, routine, unskilled nature.

The high rank which the neuropsychiatric veterans attained in the personal-social field does not necessarily indicate that a large number of neuropsychiatric veterans are peculiarly adapted to personal-social occupations, or that they have a better-than-average chance of succeeding in them. It may indicate that the veterans are attempting to compensate for a lack of satisfactory social relationships. In choosing the personal-social occupations, they may be expressing the loneliness and isolation which they have experienced in consequence of the disruptive influences of war. No doubt there are other factors which have a bearing on the choices they made; but whatever the causes for such preferences, the fact remains that a large number of neuropsychiatric veterans seem to crave occupations which involve associating with and serving other people.

Yet the California Test of Personality, the Bell Adjustment Inventory, and the Bernreuter Personality Inventory point to the conclusion that many of these same veterans feel socially inadequate, dependent, and unable to compete successfully with other individuals. This feeling of inadequacy seems to be reflected in the large number of items selected in the natural field (farming, fishing, forestry, and other outdoor work). The competition in this field is perhaps less pronounced and duties less exacting than in, say, the field of science, in which the neuropsychiatric veterans attained the lowest percentile rank of any group. The fact that their level of interests is lower than that of the other groups suggests that the neuropsychiatric veterans, feeling inadequate as they do, tend to select occupations which are below average in difficulty.

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[2] Data concerning non-hospitalized veterans — in Los Angeles, San Francisco, Brown University, and rural areas — were received in letter dated March 15, 1950, from the California Test Bureau, Los Angeles, California.

This tendency may be due in part to the fact that during the war years many of the veterans were deprived of the normal educational and socializing influences. They were taught how to fight but not how to enter into satisfying occupational and social relationships. They were taught how to take orders but not how to assume the responsibilities of family and community life. It is not surprising, therefore, that many of them returned from the service unable to adjust satisfactorily to the problems of everyday living.

Summary

One of the chief problems at a neuropsychiatric hospital is that of getting the patient to make a realistic appraisal of his occupational potentialities. Progress in this direction is being made through administering occupational interest inventories to all types of mental patients.

The value of the program seems greater when interviewing and testing are accomplished on the admission ward as soon as possible after the patient is admitted to the hospital. Early testing puts the patient in a frame of mind receptive to treatment, and provides information which can be used to integrate the activities of the different departments during the early stages of the rehabilitation program.

When a patient is discussing his occupational problems, he often reveals information about his mental condition which he would not divulge if questioned directly on the subject. Such information is of value to the ward physician and other personnel.

The findings of the survey indicate that many neuropsychiatric veterans prefer occupations which are below average in difficulty and which involve associating with or serving other people. Such preferences, it is believed, are due to the veteran's feeling lonely, dependent, and inferior — as a result of the disruptive influences of war.

To assist in overcoming these feelings of inadequacy, the educational therapy section and other services of the Veterans Administration hospital offers friendly and sympathetic advice, and extends to the veteran opportunities for social and vocational education which he missed while serving in the armed forces.

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ARCHIVES of PHYSICAL MEDICINE
OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL MEDICINE

.·. EDITORIALS .·.

THE THIRTIETH ANNUAL CONGRESS

The recent meeting of the Congress in New York was a noteworthy one for many reasons. To begin with it was our thirtieth anniversary and in keeping with the rapid growth in our specialty we again changed our name, we hope for the last time, to the *American Congress of Physical Medicine and Rehabilitation.* The ARCHIVES will also follow suit and we now have our American Medical Association section, our specialty board, Society, Journal and Congress all in agreement as to nomenclature. The vote was unanimous and without discussion as contrasted with former heated arguments pro and con.

As might be expected a highlight of the occasion was the presidential address by Robert L. Bennett. He discussed the timely and important subject that of the training of the specialist in our field. As Secretary of the American Board of Physical Medicine and Rehabilitation he is in an authoritative position to give us the true facts at this time. His address which is the lead article of this issue should be studied by all concerned with training residents and also it is hoped by all concerned with interesting talented young doctors in our specialty.

The second John Stanley Coulter memorial lecture was another important event of our thirtieth Congress. All who were fortunate enough to know Doctor Coulter would have realized what great pride he would take in our specialty in its latest development, that of the meeting of our International Congress of Physical Medicine in London in July. No one but his beloved friend Frank Krusen could have made such a masterly and interesting presentation of the events celebrating this occasion. His numerous lantern slides helped us visualize and remember this historic meeting. All those who missed this address will want to read about it in the ARCHIVES.

As usual one of the most exciting moments of the Congress was the announcement of the winners of the Gold Key Awards at the Banquet. This year the choice of the Committee and a most popular one, was that of Mr. Basil O'Connor, president of the National Foundation for Infantile Paralysis for the past fifteen years. His interest in and work for the development of Physical Medicine and Rehabilitation as it relates to the patient with poliomyelitis and also the specialty as a whole is well known to us and we are all grateful for his support over the years and for his keen interest in its continuing growth. Those who were privileged to listen to his speech, the feature attraction of the banquet, were tremendously impressed by his intimate knowledge of some of the problems which confront us in trying to make it possible to supply adequate physical medicine and rehabilitation services to those needing it, particularly those with muscular weakness from poliomyelitis. Our readers are all invited to share in this inspiring address by reading it on the pages of the ARCHIVES.

The scientific program as intended for a very diversified audience contained papers covering multiple aspects of our broad field. These included clinical papers summarizing present methods of treatment intended for the general practitioner, laboratory studies particularly in relation to ultrasound for the men in research, and numerous accounts of new techniques of value in Physical Medicine and Rehabilitation procedures. The program committee regretted that the number of papers presented had to be curtailed in keeping with the vote of the Congress in Denver and recommended that we again return to the policy of double sessions in the mornings.

The educational conference and instructional courses under the able leadership of Earl Elkins again featured a galaxy of talented lecturers. It is to be hoped that much of this material will become available to the readers of the ARCHIVES in future issues. Another valuable educational project was the assembly of scientific exhibits which again were excellent. The list of winners appears elsewhere in this issue.

In looking to the future we are glad that we have such a strong president in Walter Solomon to carry on in Doctor Bennett's footsteps. Many of the members have been thinking of means to strengthen the organization particularly in reference to making the Congress a truly specialty group without giving up its role of educating the general surgeon and physician in utilization of physical medicine in his practice. The executive council discussed this topic but it has not as yet been brought to the attention of the membership. One suggestion worthy of further consideration is that the voting membership be limited to certificates of the American Board of Physical Medicine and Rehabilitation who would be known as Fellows of the Congress. Membership requirements for others would remain as at present. The fellows would in effect be also the members of the present American Society of Physical Medicine and Rehabilitation and would govern the policies and actions of the Congress. Under existing rules others outside of the specialty often consider membership in the Congress practically the same as qualification as a recognized physiatrist although there is nothing in our membership requirements to justify this. After careful consideration during the coming year it may be possible to take some action at the next Congress meeting to further strengthen our standing even though it requires another constitutional amendment.

Again all best wishes for success to our incoming president, Walter Solomon, during our thirty-first year.

AWARD OF MERIT BY THE AMERICAN CONGRESS OF PHYSICAL MEDICINE AND REHABILITATION FOR THE YEAR 1952

The Committee on Gold Key Awards announced through its Chairman, Dr. Gordon M. Martin. the following recipient:

BASIL O'CONNOR, New York City, in recognition of his contribution to the advancement of the science and art of Physical Medicine by tireless efforts to ensure the best possible treatment for the rehabilitation of victims of poliomyelitis throughout the world and by continuing support of research and education of which the ultimate goal is the eradication of the crippling effects of the disease.

AWARDS TO SCIENTIFIC EXHIBITORS

The Committee on Awards for Scientific Exhibits presented through its Chairman, Dr. William H. Schmidt, the following:

Gold Medal to Robert Denton, 1st Lt., USAF (MC), and Joseph N. Schaeffer, Lt. Col., USAF (MC), for the exhibit, "Continuous Oxygen-Rich Aerosol for the Tracheotomized Respirator Patient."

Silver Medal to William G. Kubicek, Ph.D., and Frederic J. Kottke, M.D., for the exhibit, "Gas Flow Rates During Respiration."

Bronze Medal to Robert C. Darling, M.D., and Edward E. Gordon, M.D., for the exhibit, "Integrated Rehabilitation Services at the Institute for the Crippled and Disabled."

Honorable Mention to John H. Kuitert, Lt. Col. (MC), for his exhibit, "Prosthetic Training for the Upper Extremity Amputee: Special Problems, for Cineplasty," and to Eugene Neuwirth, M.D., for his exhibit "Table for Vertebral Elongation."

MEDICAL NEWS

Members are invited to send to this office items of news of general interest, for example, those relating to society activities, new hospitals, education, etc. Programs should be received at least three weeks before the date of meeting.

American Congress of Physical Medicine and Rehabilitation Officers 1953

Walter M. Solomon, M.D., Cleveland, Ohio, President.

William B. Snow, M.D., New York, N. Y., President-Elect.

William D. Paul, M.D., Iowa City, Iowa, First Vice-President.

Howard A. Rusk, M.D., New York, N. Y., Second Vice-President.

Gordon M. Martin, M.D., Rochester, Minn., Third Vice-President.

A. B. C. Knudson, M.D., Washington, D. C., Fourth Vice-President.

Donald L. Rose, M.D., Kansas City, Kan., Fifth Vice-President.

Frances Baker, M.D., San Mateo, Calif., Secretary.

Frank H. Krusen, M.D., Rochester, Minn., Treasurer.

Walter J. Zeiter, M.D., Cleveland, Executive Director.

Dorothea C. Augustin, Chicago, Executive Secretary.

Other Officers Named for 1953

Dr. **Walter M. Solomon** of Cleveland was elected to succeed himself to serve a term of three years on the financial committee.

Dr. **Fred B. Moor** of Los Angeles was reappointed to serve a term of six years on the Editorial Board of the ARCHIVES OF PHYSICAL MEDICINE.

Dr. **Robert L. Bennett** of Warm Springs, Ga., was appointed to serve a term of seven years on the Board of the American Registry of Physical Therapists, beginning January 1, 1953.

Dr. **William Schmidt** was re-elected to the American Board of Physical Medicine and Rehabilitation for a six year term as a representative of the American Congress of Physical Medicine and Rehabilitation.

Meeting of American Academy

The American Academy for Cerebral Palsy announces that its annual meeting was held in Durham, North Carolina, October 2-4. Scientific sessions were open to physicians interested in the problem of cerebral palsy. The sessions were held at the Cerebral Palsy Hospital at Duke University.

Rehabilitation Beach

The Institute of Physical Medicine and Rehabilitation, New York University-Bellevue Medical Center, New York City, recently opened a swimming pool and beach for disabled children. Instructors are provided by the Red Cross.

Amendments Approved at Congress Meeting

At the 30th annual session of the American Congress of Physical Medicine held in New York, August 25-29, 1952, the following amendments to the Constitution and By-Laws were made:

1. Amend Constitution, Article I, to read as follows:

"Article I — Name

The name of this organization is the American Congress of Physical Medicine and Rehabilitation, hereafter referred to as the Congress."

2. Amend Article VIII, Section 1, to read as follows:

"This organization shall operate a Registry for the purpose of maintaining a list of physical therapists competent and qualified to administer adequate physical therapy under the specific prescription and direct supervision of licensed physicians.

"All matters pertaining to the functioning of the Registry shall be managed by a Board of Registry which shall be composed of nine members. Seven members shall be appointed by the president of the Congress and confirmed by the voting members of the Congress. Two members shall be designated by the American Physical Therapy Association and shall serve during the pleasure of that organization. The members appointed by the Congress shall assume office January 1 following their appointment. Only such members of the Congress as are in good standing in the Congress and practice physical medicine exclusively shall be appointed to represent the Congress on the Board. Each member appointed by the Congress to serve on the Board shall serve a term of seven years, so arranged that the ultimate objective shall be one appointment and one confirmation annually. If before the expiration of the term for which appointed and confirmed a member of the Board representing the Congress dies, is removed or becomes disqualified, the president of the Congress shall designate a qualified person to serve the unexpired portion of the term and the person so designated shall assume office immediately."

3. Amend Constitution, Article X, Section 1, as follows:

"Article X, Section 1 — Name

The official publication of the Congress is the Archives of Physical Medicine and Rehabilitation in which shall be published all official Congress notices and transactions of sessions of the Congress, either in abstract or in full. The management of the Archives of Physical Medicine and Rehabilitation shall be vested in an Editorial Board to be constituted as provided for in the succeeding section."

4. Amend Constitution, Article XVI, to read as follows:

"This Constitution may be amended in whole or in part at any annual business meeting by a two-thirds vote of all voting members present and voting provided that prior to that time the amendment —

(1) Has been presented in writing at the previous annual business meeting, and

(2). A copy of the proposed amendment, together with a notice that the matter will be voted on is sent by mail to each member or is published in the Archives of Physical Medicine and Rehabilitation not less than one month in advance of the annual business meeting at which action is to be taken."

The name of the journal will be changed beginning January, 1953.

A. M. A. Physical Laboratory

The A. M. A. headquarters in Chicago has recently opened a physical laboratory for testing devices submitted to the Council on Physical Medicine and Rehabilitation. Dr. Frederic T. Jung is Director of the laboratory.

Newly Registered Therapists

August 4, 1952

Barron, Priscilla Ann, 2020 S. Hillside, Wichita, Kan.

Christiansen, Margaret Jeanette, 9 E. Bridge, Blackfoot, Idaho.

Christophersen, Philip Harlan, 2906 Charles, St. Joseph, Mo.

Kennedy, Rosemary, 205 Greenway Rd., Salina, Kan.

Passmore, Norma June, Elmdale, Kan.

Schroff, Carle Highland, 305 Miami, Hiawatha, Kan.

Sellers, Alice Ann, 306 E. Kaskaskia, Paola, Kan.

Sprout, Thelma Loraine, 208 W. Wisconsin, Greensburg, Kan.

August 12, 1952

Cranmore, Charlotte L., Box 556, Ocala, Fla.

Dabato, Rosie, 1014 Gaston Ave., Fairmont, West Va.

Dean, Doris Ophelia, Avalon, Ga.

Gridley, Harold Dick, Lenora, Kan.

McCarthy, Dorothy Irene, 3228 January Ave., St. Louis 9, Mo.

McKinley, Harriet Jo Ann, 1634 N. Holyoke, Wichita 14, Kan.

Morris, Jeanne Beall, 800 Wheless Ave., Kerrville, Texas.

Tornquist, Axel Henning, 5012 8th Ave., Brooklyn, N. Y.

Turner, Claire Jean, 24 Outlook St., Newport, Vt.

August 20, 1952

Kinnison, Dorothy Muriel, Box 617, Monroe, La.

August 27, 1952

Anderson, Barbara Menke, 3507 Abby Lane, Jacksonville, Fla.

Buckham, Rodney Tellar, Jr., 142-20 41st Ave., Flushing, N. Y.

Fay, Margaret, 612 W. 115th St., New York 25, N. Y.

Featherman, Joan Mitchell, 102 Main St., Dalton, Pa.
Hasselbrock, Anna, 310 Birch St., Scranton 5, Pa.
Hill, Alvin, 200 Claremont Ave., Apt. 43, New York, N. Y.
Keenan, Kathleen Theresa, 175 Beach 132 St., Belle Harbor, L. I., N. Y.
Kravis, Herbert Zachary, 111 Cedar Ave., Newark 6, N. J.
Krug, Joan Gettell, 490 Bleeker Ave., Mamaroneck, N. Y.
Meinhold, Carol Lois, 81 Centennial Ave., Brockport, N. Y.
Stenner, Nancy Ann, 2186 Five Mile Line Rd., Penfield, N. Y.
Strumfeld, Dorothy, 448 Cyrus Pl., Bronx 58, N. Y.
Wagner, Donald Bert, 624 E. Philadelphia St., York, Pa.
Walters, Raymond Odean, 31 S. Bentley Ave., Niles, Ohio.
Zelmanowitz, Margaret M., 195 Kingston Ave., Brooklyn 13, N. Y.

September 1, 1952

Branes, Gordon Keith, 1219 Cypress St., St. Paul 6, Minn.
Cudworth, Paul Floyd, 1911 Pinecrest Drive, Ferndale 20, Mich.
Field, Helen Erline, 48 Prospect St., Cuba, N. Y.
Gray, Ella Frances, 5 Peck Street, Bristol, R. I.
Hammond, Eleanor Jean, Cape Vincent, N. Y.
Harms, Richard Milton, 4610 Park Blvd., Wildwood, N. J.
Jackson, John T., 1227 Warner St., Pittsburgh 12, Pa.
Jackson, Margaret Louise Schreiber, 84 Prospect Street, Attica, N. Y.
Kaneko, Marion Hideko, 908 Middle Avenue, Menlo Park, Calif.
Kimmel, Bernard, 520 S. Pleasant St., Royal Oak, Mich.
King, Jane, Hedgecroft Hospital and Clinic, Houston, Texas.
Kruse, Robert Douglas, 1337 Lenox Ave., Detroit 15, Mich.
Menefee, Dorothy Frances, 1150 First St., S. W., Rochester, Minn.
Morey, Margaret Alice Hise, 312 Center St., East Aurora, N. Y.
Nelson, Mildred Louise, Box 55, Ludlow, Pa.
Odell, David Field, 204 E. Main St., Beacon, N. Y.
Onishi, Nobuko Notch, Box 128, Garfield, Utah.
Shaffer, Dale Vernon, 170 Maple St., Slippery Rock, Pa.
Street, Sarah Anne, 817 Euclid Ave., Syracuse, N. Y.
Tate, Margaret Joyce, 2407 Twelfth St., Altoona, Pa.
Weidler, Oscar Paul, 1328 Second St., S. E., Rochester, Minn.
Wilk, Edwina Frick, 304 Vinta Rd., Manitou, Colo.

New Congress Members

The following were elected to membership in the American Congress of Physical Medicine and Rehabilitation at the recent New York meeting:

Adams, Ernest, Percy Jones Army Hospital, Battle Creek, Mich.
Andelman, Sumner Yale, 1611 S. Boston Ave., Tulsa, Okla.
Baer, Adrian D., 13635 E. 13th Ave., Denver 8, Colo.
Bankert, Charles W., 100 Lafayette Blvd., Williamsville 21, N. Y.
Benton, Joseph G., NYU-Bellevue Medical Center, 477 1st Ave., New York 16, N. Y.
Bingham, Robert, 3205 Main St., Riverside, Calif.
Brittis, Anthony L., 78 Park Hill Ave., Yonkers 2, N. Y.
Brock, Ralph L., Valley Forge Army Hospital, Phoenixville, Pa.
Doman, Robert J., 5214 Bella Vista Rd., Drexel Hill, Pa.
Dugdale, Frederick E., 203 S. Cleveland Ave., Wilmington 5, Del.
Erdman, William J., II, 3600 Spruce St., Philadelphia 4, Pa.
Fillmore, R. S., VA Center, Temple, Texas.
Fowler, John R., 11506 77th Ave., Edmonton, Alberta, Canada.
Gaston, John Zell, Box 147, Webster, Texas.
Goldman, Joel, 13 E. Market St., Lewistown, Pa.
Goodgold, Joseph, Valley Forge Army Hospital, Phoenixville, Pa.
Gullickson, Glenn, Jr., 1730 Irving Ave., S., Minneapolis 5, Minn.
Keever, Kenneth W., Warm Springs Fdn., Warm Springs, Ga.
Kelly, William J., 1565 Jasmine St., Denver 7, Colo.
Kristeller, Edith Lind, 414 W. 121st St., New York 27, N. Y.
Lane, Alfred L., 501 Main St., W., Rochester 8, N. Y.
Leass, Reuben, 1240 Beach 9th St., Far Rockaway, N. Y.
Mahl, Murray M., 334 E. 91 St., Brooklyn 12, N. Y.
Mautner, Herman E., 5101 18th Ave., Brooklyn, N. Y.
McCartney, James L., 223 Stewart Ave., Garden City, N. Y.
McMorris, Rex O., 1301 13th Ave., N. E., Rochester, Minn.
Moore, Walter H., Letterman Army Hospital, Box 13, San Francisco, Calif.
O'Rourke, William J., Veterans Administration Hospital, Richmond 19, Va.
Read, Joseph C., 384 Peachtree St., N. E., Atlanta 3, Ga.
Rogers, Eugene J., U. S. Army Hospital, Camp Gordon, Augusta, Ga.
Rubin, David, 1815 Ocean Front, Santa Monica, Calif.
Schram, Duane A., Gonzales Warm Springs Fdn., Gonzales, Texas.

Stillwell, George K., 2333 Priscilla Ave., St. Paul 8, Minn.
Sutton, Bruce B., Pearl Rd., Strongsville, Ohio.
Tarafa, Jose Ignacio, Calle 23 #508, Vedado, Havana, Cuba.
Throne, Elias M., 48 Cambon Dr., San Francisco 27, Calif.
Welsh, Edwin C., Wood, Wis.
Wickler, Gerhard S., Outwood, Ky.

Physical Therapy Degree Offered

The University of Buffalo, Buffalo, N. Y., recently announced the establishment of a program in physical therapy, offering a degree. The program began with the September semester. A four year program will lead to a bachelor of science degree with a major in physical therapy. A 12-month course leading to a certificate of proficiency in physical therapy is offered only to students of advanced standing. The program will meet standards established by the Council on Medical Education and Hospitals of the American Medical Association, the American Physical Therapy Association, the American Registry of Physical Therapists, and the New York State Department of Education. Dr. Henry V. Morelewicz is Medical Director of the program.

Polio Booklets

The National Foundation for Infantile Paralysis has issued two new booklets on polio, namely, "Management of Poliomyelitis Patients with Respiratory Difficulty" and "Isolation Techniques and Nursing Care in Poliomyelitis." The booklets may be obtained by writing to the foundation at 120 Broadway, New York 5, N. Y.

Kessler Institute Fall Conference

A full day conference on the rehabilitation of paraplegics was given on October 10 at Kessler Institute for Rehabilitation. Drs. Arthur S. Abramson and Howard A. Rusk participated in the panel discussions.

Personals

Dr. **Jerome S. Tobis** has recently been appointed Director and Associate Professor of the newly created Department of Physical Medicine and Rehabilitation at the New York Medical College, Flower-Fifth Avenue Hospital.

Dr. **William B. Snow** of New York was a guest lecturer at the rehabilitation symposium held at the Jewish Sanitarium and Hospital for Chronic Diseases in September.

At the recent New York meeting of the Congress, Dr. **Walter J. Solomon** was elected Chairman of the Editorial Board of the ARCHIVES.

Dr. **Arthur A. Rodriquez,** Chicago, Illinois, addressed the Illinois State Nurses' Association on October 10. The title of his talk was "Newer Concepts and Techniqües of Physical Rehabilitation."

Dr. **Herbert Kent,** Chief, Physical Medicine Rehabilitation, Veterans Administration Hospital, Indianapolis, Indiana, participated as a resource person in the "Workshop on Gerontology" at Indiana University, Bloomington, Indiana, on September 25-26, 1952. The topic, "Opportunity for Good Health Practices and Rehabilitation of Disabilities," was discussed.

Dr. **Louis B. Newman** delivered a lecture at the Annual Convention of the American Association of Rehabilitation Therapists, New York City on September 3, 1952. Dr. Newman's presentation was on "The Significance of Total Rehabilitation."

At the October meeting of the American Academy for Cerebral Palsy, held in Durham, N. C., the following participated: Joseph E. Markee, Ph.D., showed film on "Functional Anatomy of the Hand"; **George G. Deaver,** M.D., spoke on "Clinical Approach to the Etiology of 100 Cases of Cerebral Palsy and Its Correlation with Signs and Symptoms"; Temple Fay, M.D., presented "Effect of Carbon Dioxide and Oxygen Inhalation on Movement and Muscular Hypertonus in Athetoids; and **Lenox D. Baker,** M.D., Spoke on "Review of Surgical Procedures in Cerebral Palsy."

BOOK REVIEWS

The reviews here published have been prepared by competent authorities and do not necessarily represent the opinions of the American Congress of Physical Medicine and Rehabilitation.

ANNUAL REVIEW OF PHYSIOLOGY. *Victor E. Hall,* Editor, University of California School of Medicine, Los Angeles; *Jefferson M. Crismon,* Associate Editor, Stanford University; *Arthur C. Giese,* Associate Editor, Stanford University. Volume 14. Cloth. Price, $6.00. Pp. 589. Annual Reviews, Inc., Stanford, Calif, 1952.

The Annual Review of Physiology is one of those unusually stimulating volumes that will always contain valuable information for readers of very diverse interests. It is a necessity for the physiologist, but it is almost as essential to the clinician who is desirous of keeping ahead of new developments and trends as related to his particular medical specialty.

The Prefatory Chapter on the organization of Science has been written by Doctor Ralph Gerard of the University of Chicago. He traces science from its elemental and simple beginnings to the extremely complicated and highly organized complexity it presents today.

Doctor Gerard states that in the making of observations, in the development of interpretations, and in the communication of information, we come up against the problem of organization. At present, he says, and for the foreseeable future, basic science must look to government for support, abetted to some degree by industry. Scientists who have undertaken contracts with the Office of Naval Research and the U. S. Public Health Service have found to the surprise of many a minimum of red tape and paper work and complete freedom in prosecution of research. It is thus a reasonable expectation that the new National Science Foundation will perform as well.

The 1952 volume is the largest since 1949. While it must be a difficult task to select topics and reviewers for each annual review, the task confronting the reviewer selected is certainly a formidable one. In each instance, however, the work has been done with remarkable skill and interpretation. David Waugh, Department of Biology of M. I. T, reviews the physical properties of protoplasm. Growth is reviewed by L. J. Wells, of the University of Minnesota, in which sexual differentiation and the development of function are emphasized. Charles Ragan, Department of Medicine, Columbia University College of Physicians and Surgeons, reviews the physiology of the connective tissue, the main purpose of which is to consider loose connective tissue of the adult organism to which four definite functions have been described: support, transport, storage, and repair and protection. Robinson, of Indiana, reviews the physiological effects of heat and cold. The physiatrist will find this a profitable chapter. Spiegelman, of the University of Illinois, and Sussman, of Northwestern, review energy metabolism of biosynthesis at the cellular level in terms of enzymes and aggregates of enzymes. The interesting subject of water metabolism is reviewed by Robinson and McCance of the Department of Experimental Medicine, Cambridge University, England. James Whittenberger, of Harvard School of Public Health, reviews the respiratory system. He states that a wholly satisfactory interpretation of the integration of all the factors regulating respiration has yet to be developed. The first of a series of chapters is presented on comparative physiology, the first of which is written by Wiersma, of California Technical Institute, and deals with invertebrate muscle. Wiersma's review covers material of the past five years. Physiology of the digestive system is covered by Wilhelmj, of Creighton University. Fundamentals of blood clotting are reviewed by Flynn and Coon, of Columbia University; blood gas transport by Wood, of Minnesota; peripheral circulation by Pappenheimer, of Harvard; the heart by Gunnar Biörck, Sweden; the lymphatic system by Richard Webb, of Indiana University School of Medicine; the kidney by Corcoran, Dustan, and Masson, of the Cleveland Clinic; excitation, conduction, and synaptic transmission in the nervous system by Brooks and Fuortes, of State University of New York College of Medicine; somatic function of the central nervous system by Marion Hines, of Emory University; visceral functions of the nervous system by Albert Kunz, of St. Louis; hearing by Gerandt, of Gothenburg, Sweden; the pituitary-adrenal system by J. W. Conn and Stefan Fajans, University Hospital, University of Michigan; the thyroid gland by Albert, of the Mayo Clinic; reproduction by Hartman, of the Ortho Research Foundation, New Jersey; and the physiology of the skin by Farber, of Stanford, and Lobitz, of Dartmouth Medical School. The volume closes with author and subject indexes. This volume is highly recommended for the physiatrist. In these days of high costs it is pleasing to find so valuable a work produced at such a moderate price.

FROM DUGOUT TO HILLTOP. By *Margaret R. Stewart,* M.D. Cloth. Price, $3.75. Pp. 233. Dr. Margaret R. Stewart, 916 East Monterey Road, Glendale 6, Calif., 1951.

An autobiography of a woman physician which tells the experiences and difficulties encountered both as a physician and as a mother of a family. The title expresses the beginning on a farm in Nebraska to the time of her retirement to a home in California.

MAN AND HIS YEARS: AN ACCOUNT OF THE FIRST NATIONAL CONFERENCE ON AGING.

Sponsored by Federal Security Agency. Paper. Price, $1.75. Pp. 311. Health Publications Institute, Inc., 216 N. Dawson St., Raleigh, N. C., 1951.

This is an interesting report of a series of conferences on problems of aging conducted by a large group of persons including an advisory committee of fifty-six persons, a central staff of twenty-nine workers, and a group of thirty-four guests. Many physicians were included among these participants. The conference was arranged because President Truman requested the Federal Security Administrator "to explore with all appropriate groups, both within and outside of the Federal Government, the problems incident to our increasingly older population."

The book itself is divided into fourteen parts starting with a section on "Our Aging Population" by Oscar R. Ewing, Federal Security Administrator. The second section describes the conference and is written by John L. Thurston, Deputy Federal Security Administrator. There are also sections on the following subjects: population changes and economic implications; income maintenance; employment, employability, and rehabilitation; health maintenance and rehabilitation; education; family life, living arrangements, and housing; creative and recreational activities; religious programs and services; professional personnel; aging research; community organization; and a final section by the Conference Director, Clark Tibbits, entitled "Next Steps."

Of particular interest to the physiatrist is the section on health maintenance and rehabilitation. The group concluded that "Treatment and care cannot be said to be complete without adequate rehabilitative measures" and that "Medical rehabilitation can retard the progression of disease in many older persons; in others it can restore functions, either wholly or in part; in still others, it can correct a disability entirely. Particularly in later maturity and senescence, rehabilitation services can often bring disabled persons back to the point of self-care and sometimes to full or limited employment."

The group recommended specifically that in providing treatment and care for disabled older persons it is necessary to: "Study and evaluate the community resources for making adequate medical care available to older people. Aim at restoration of older persons to the fullest possible physical, mental, social, vocational, and economic usefulness. Plan institutional facilities and services to accord with the varying needs of the aged."

In summing up, Tibbitts concluded that activity in solving the problems of the aged has increased because "we believe in the dignity of the individual and in the right to live life completely" and we are achieving "a broadening realization that the well-being and the participation of older people are essential to national security and the discharge of our international obligations."

This book should be read by every physician interested in geriatrics and by all physicians interested in rehabilitation of the disabled. It contains a wealth of material and summarizes the ideas of a large group of experts in various phases of the problems of aging.

CEREBRAL MECHANISM IN BEHAVIOR.

The Hixon Symposium. *Edited by Lloyd A. Jeffress,* Professor Psychology, University of Texas. Cloth. Price, $6.50. Pp. 311, with illustrations. *John Wiley & Sons, Inc., 440 Fourth Avenue,* New York 16, 1951.

This book is the report of a symposium held at the California Institute of Technology in September, 1948. The topic of the symposium was "Cerebral Mechanisms" and to discuss it, an eminent group of scientists was brought to the Institute under auspices of the Hixon Fund Committee. The following papers were presented: the general and logical theory of automata by John von Neumann, Professor of Mathematics, Institute of Advanced Study; why the mind is in the head by Warren McCulloch, Professor of Psychiatry, University of Illinois; the problem of social order in behaviour by K. S. Lashley, Research Professor of Neuropsychology, Harvard; functional differences between the occipital and temporal lobes with special reference to the interrelations of behaviour and extra-cerebral mechanisms by Heinrich Klüver, Professor of Experimental Psychology, Chicago; relational determination in perception by Wolfgang Köhler, Research Professor of Philosophy, Swarthmore; brain and intelligence by Ward C. Halstead, Professor of Experimental Psychology, Chicago; and the symposium from the viewpoint of a clinician by Henry W. Brosin, Professor Psychiatry, Pittsburgh. An equally distinguished group formed a discussion panel.

Stenotype operators recorded the talks and discussions. The speakers revised and corrected these original records. The editor, Lloyd A. Jeffress, Professor of Psychology, Texas, then had the difficult task of cutting, patching, and omitting repetitious sections and irrelevant fragments of the material submitted. While such a procedure has taken a great deal of time, the result is undoubtedly a better book and one more nearly representing the authors' views. Dr. Jeffress is to be congratulated for having accomplished his purpose so well.

This is a series of lectures that will not interest the average clinician but should interest the psychiatrist who wishes to delve into the basic science and concepts of human behaviour. The book is particularly valuable in view of the extensive discussion which followed presentation of each paper.

PRESCRIPTION FOR MEDICAL WRITING. A USEFUL GUIDE TO PRINCIPLES AND PRACTICE OF EFFECTIVE SCIENTIFIC WRITING AND ILLUSTRATION. By *Edwin P. Jordan*, M.D., and *Willard C. Shepard.* Cloth. Price, $2.50. Pp. 112, with 26 illustrations. W. B. Saunders Company, West Washington Square, Philadelphia, 1952.

Perhaps the most distinctive feature of this excellent manual is Chapter X by the senior author, Dr. Jordan, "Statistics Employed in Medical Papers." This chapter offers a competent introduction to such use of statistical methods, though its greatest value would appear to be the stimulus it affords the reader to delve more deeply into the subject with the aid of the list of references supplied. The author is to be highly commended for stressing the impossibility of proving a hypothesis by means of statistics and for pointing out the pitfalls that await an unsuspecting author using this tool. The sections on presentation of statistical data are admirably illustrative and informative. A fuller explanation of the use of the zero base line might well have been given, especially its value in a series of "pie" diagrams. No such base line is given in the illustration of this device which appears in the text. The author is also to be commended for pointing out the fallacy of using percentages when fewer than 100 observations are involved.

The chapter on illustrations, prepared by the associate author, Mr. Shepard, gives the impression of being written by a photographic technician rather than an editorial expert, though this does not detract from its value. As compared with similar chapters in other manuals it is adequate and complete, giving the usual instructions as to preparation and reproduction of drawings and photographs, with valuable advice on proper emphasis and unified, intelligible presentation.

The book faithfully lives up to the Latin motto appearing on the title page, Quidquid Praecipies Esto Brevis — Whatever you undertake be brief. Indeed, one might wish that the senior author had been more prodigal with the cogent advice and suggestions contained in the first seven chapters, which deal with the practical questions of actual preparation of a manuscript from the first preliminaries to the making of an index. He certainly is equipped to do so. Taken together these chapters amount to a sound and practical dissertation on the rhetorical principles of Unity, Mass and Coherence — with the medical writer always in mind.

YOUR MIND AND APPEARANCE: A PSYCHOLOGICAL APPROACH TO PLASTIC SURGERY. By *Adolph Abraham Apton,* M.D. Cloth. Price, $3.00. Pp. 212, with 28 illustrations. Citadel Press, 120 E. 25th St., New York 10, 1951.

This is another book by a plastic surgeon designed to describe the many beneficial operations now possible and their psychological value to the patient. Numerous case histories are used and discussed in lay terms. It does not have the technical details to interest the plastic surgeon and is too superficial for the psychiatrist. It is of some interest to laymen in rehabilitation work as a reference in regard to use of plastic surgery.

CARDIAC EMERGENCIES AND HEART FAILURE. PREVENTION AND TREATMENT. By *Arthur M. Master,* M.D., Cardiologist, Mount Sinai Hospital, New York, N. Y.; *Marvin Moser,* M.D., 1st Lt., USAF (MC), Walter Reed Army Hospital, Washington, D. C. Former Fellow, Cardiology, Mount Sinai Hospital, New York, N. Y., and *Harry L. Jaffe,* M.D., Adjunct Physician, Cardiology, Mount Sinai Hospital, New York, N. Y. Cloth. Price, $3.00. Lea & Febiger, Washington Square, Philadelphia 6, 1952.

This is a text containing a great quantity of practical information on the prevention, diagnosis and treatment of cardiac emergencies and heart failure. Although small in size with only 159 pages and 13 illustrations, it is indeed large in the wealth of wisely selected medical information. Of particular note is the most adequate coverage given cardiac arrhythmias, acute pulmonary edema and congestive failure, and angina pectoris. Also covered are cardiac syncope, rheumatic heart disease, hypertensive encephalopathy, dissecting aneurysm, traumatic heart disease and surgical emergencies in cardiovascular disease. Exact treatment methods are presented including adequate interval therapy. Case histories and illustrations have been used to great advantage to explain more completely specific cardiac conditions and their response to treatment. Commonly accepted drugs as well as the newer drugs are discussed. Throughout the text physiology and pathology of the various conditions are discussed as they relate to the treatment problems of the particular disorder.

The value of this text cannot be easily described. The clear, concise, well-written style of the authors plus the very practical aspects of the text's contents throughout make it most desirable for use by students, residents, general practitioners and internists, as well as an addition for every working medical library.

CHIROPODIAL ORTHOPAEDICS. By *Franklin Charlesworth,* F.Ch.S., Consultant Chiropodist, Hope Hospital, Salford; School Health Service, Salford; Department of Civic Welfare, Salford. Member of Panel of Examiners, Society of Chiropodists. Sometime Director of Studies, East Lancashire Foot Hospital School of Chiropody. Foreword by *Sir Harry Platt,* M.S., F.R.C.S., F.A.C.S., Professor of Orthopaedic Surgery, University of Manchester. Cloth. Price, $5.50. Pp. 255, with illustrations. The Williams & Wilkins Company, Mt. Royal and Guilford Avenues, Baltimore 2, 1951.

This monograph describes in detail with the assistance of frequent and excellent photographs methods of making and fitting a variety of pads, molds, and foot supports which the author has found successful in his practice. Some illustrative case histories are also presented.

Orthopedic surgeons, physiatrists and chiropodists will find this book of interest and value.

MEDICAL ETHICS AND THEIR EFFECT UPON THE PUBLIC. By *Louis Guenzel.* Cloth. Price, $2.00. Pp. 79. Vantage Press, Inc., 230 West 41st Street. New York 18, 1951.

In this small book criticism is leveled at the conservative code of medical ethics which forbids advertising, financial awards for scientific discoveries, and demands critical analysis of new methods of treatment before acceptance. The author feels that this rigid code is preventing low cost medical care and causes poor public relations. The forcefulness of the arguments is weakened by personal and normal prejudice in reference to the author's own symptoms of arthritis apparently alleviated by a doctor's method of treatment which did not receive the approval of the medical profession.

The subject of ethics and their effect on public relations is not to be overlooked as there is certainly room for improvement, and this volume is worthy of serious study by the profession.

METHODS IN MEDICINE. By *George R. Herrmann,* M.D., Ph.D. Second Edition. Cloth. Price, $7.50. Pp. 488. The C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, 1950.

This manual has been planned as a practical ward or bedside guide for the clinical investigation of the common and some of the more rare diseases. Although more than an "interne's manual," its usefulness will be most apparent to the house officer or the young practitioner. The book has developed as a manual of medical practices of the service of Doctor George Dock of the Washington University School of Medicine, and attempts a comprehensive coverage of everything from history taking to some of the more unusual laboratory procedures. Special care is taken to describe the technique of history taking and the routine of the physical examination. Laboratory procedures are treated somewhat more sketchily, but on the whole adequately. The procedures described for blood chemistry methods seem oversimplified and the description given for the preparation of the reagents incomplete. Descriptions of hematological procedures are much more adequate. A general criticism of the laboratory portion of this book could be summed up by saying that it is too comprehensive for the average practitioner and too sketchy for the average clinical pathologist or technician. Of special interest and by far the best section of the manual is the third part, which deals with methods of clinical investigation. Separate chapters are devoted to infectious diseases, hematological disorders, metabolic and endocrine disorders, and so forth; these present in a concise, yet complete manner, pertinent historical, physical, and laboratory methods for each group of disease. This seems to the reviewer to be an excellent approach and one that is neglected in most textbooks of this type. The final part of the book has to do with therapeutic methods, stressing in particular techniques involved in treating medical emergencies. The book can be highly recommended for almost anyone practicing medicine, be he student, house officer, or practitioner.

THE 1951 YEAR BOOK OF PHYSICAL MEDICINE AND REHABILITATION. Edited by *Frank H. Krusen,* M.D., Professor of Physical Medicine, Mayo Foundation; Head of the Section on Physical Medicine and Rehabilitation, Mayo Clinic, Associate Editors: *Earl C. Elkins,* M.D., Assistant Professor of Physical Medicine, Mayo Foundation, Consultant in Physical Medicine and Rehabilitation, Mayo Clinic, and *George G. Deaver,* M.D., Professor of Clinical Rehabilitation and Physical Medicine, New York University College of Medicine; Director of the Department of Physical Medicine and Rehabilitation, Bellevue Hospital. Cloth. Price, $5.50. Pp. 382, with illustrations. The Year Book Publishers, Inc., 200 East Illinois Street, Chicago 11, 1952.

The Year Book for 1951 presents a ready and easily read review of the literature in Physical Medicine and Rehabilitation for that year. Its editors have carefully selected and included pertinent articles in proportions which reflect the healthy growth and expanding interests of this specialty.

"Keeping up with the literature," a difficult task for all physicians, is greatly simplified by this book. The editors' concise comments, based on their long experience in the sound practice of physiatry, following many of the abstracts add to the value of the text.

There are 366 pages of text; 117 of these contain abstracts of the literature pertaining to physcal agents and methods such as electromyography, devices and mechanical procedures, exercise, heat and cold, medical electricity, diathermy, hydrotherapy and ultrasonics. One hundred and sixty-nine pages are devoted to abstracts from the literature regarding specific conditions. These include such subjects as poliomyelitis, cerebral palsy, amputees, arthritis, peripheral vascular disease, hemiplegia, paraplegia, multiple sclerosis, and aphasia, to mention a few.

Spina Bifida and problems related to the total management of patients with this condition are presented in a special article by one of the editors and two co-authors (Deaver).

Reports in the literature on physiology and anatomy, diagnostic applications, and geriatric medicine are also included.

The editors and publishers deserve much credit for this book, which is adequately illustrated and has an attractive format. It well serves the need of the physiatrist, others interested in the clinical and basic sciences related to this specialty, the physical therapist and the occupational therapist.

MEDICAL AND PHYSICAL DIAGNOSIS. Interpretation of Findings. By *Samuel A. Loewenberg,* M.D., F.A.C.P., Clinical Professor of Medicine, Jefferson Medical College. Eighth Edition. Cloth. Price, $13.50. Pp. 1334, with 717 illustrations. F. A. Davis Company, 1914-16 Cherry Street, Philadelphia 3, 1951.

This text is a classic in medical and physical diagnosis. It is well written, well organized and contains a wealth of general information. It also contains an abundance of illustrations, diagrams and charts for ready reference to many of the medical specialties.

In general most sections are so well done that there is little room for criticism. However, it is noted that the description of Raynaud's Disease is extremely brief and Raynaud's Phenomenon secondary to other diseases has been omitted, except for brief mention with Scleroderma. Cranial or temporal arteritis, chronic venous insufficiency, and the complications therefrom have also been omitted.

A statement is made on pages 912-913, "When vitamin K is given either by mouth or parenterally, an adequate amount of bile or bile salts must be given simultaneously," which appears to be a mis-statement, inasmuch as bile or bile salts are not required with water soluble preparations of vitamin K and are not necessary when giving oil soluble prepartions parenterally.

The discussion of Lupus Erythematosis omits some of the major advances in this disease during the past few years, namely; the LE phenomenon by Hargraves and the plasma LE test by Haserick.

These criticisms are minor compared to the overall excellent qualities of this text and it can be highly recommended to students, general practitioners, and specialists in medicine.

THE RHEOLOGY OF THE CROSS STRIATED MUSCLE FIBRE. WITH PARTICULAR REFERENCE TO ISOTONIC CONDITIONS.

By *Fritz Buchthal* and *E. Kaiser*, in Collaboration with *Poul Rosenfalck*. Paper. Price, Crs. 35 (Danish). Pp. 318, with illustrations. Ejnar Munksgaard, 6 Norregade, Copenhagen K, 1951.

Rheology is a relatively new term introduced into physics about twenty years ago. Its application to physiology has been rather scarce. By definition it is a branch of physics which deals with the deformation and flow of matter. Biological structures hardly display any example of the simple type of rheological behavior, and the recent progress in the description and understanding of the complex elastic and flow properties of rubber-like substances and of plastics provides a basis for an application of these conceptions to biological systems as well.

The mechanical properties of skeletal muscle have always been a problem of special interest to physiologists, and they have been considered a central problem in the understanding of the minute structural changes underlying the mechanism of contraction. The present paper deals with properties of the isolated fibre at rest and during shortening. It represents a continuation of a study previously published in 1942, but which treated the mechanical behavior of the isolated fibre recorded at constant length. The authors have applied some of the concepts developed in modern rheology for a description of the experimental results and the minute structural interpretation. In part four a molecular model is analyzed and on its basis a theory of contraction is suggested as far as possible in quantitative terms. The authors do not pretend to present a complete survey of the literature on the mechanical behavior of muscle, but refer the reader to excellent reference sources.

The authors state they are greatly indebted to Rosenfalck for the mathematical treatment in parts two and four. The monograph is longer than the authors wished; some of the experimental material was acquired during World War II and after the war was found to need further elaboration both theoretically and experimentally.

The work is presented in four parts: part one deals with method; part two deals with rheology of the resting fibre; part three discusses the dynamics of isotonic contraction; and part four is devoted to the minute structure and interpretation of mechanical properties. Following part four there are three appendices: one, the non-linear length-tension diagram and the amplitude dependence of the stiffness; two, amplitude, dependence of vibrational stiffness; three, shortening velocity as a function of load in the isolated fibre and in whole muscle. A carefully selected list of references is included as well as a list of symbols used in this work. The book is well indexed.

While this volume will not interest the average clinician, it should find a ready welcome from physiatrists who are interested in research on muscle physiology. The physiologist will find this a most fascinating and valuable contribution to the still unsolved mystery of muscular contraction. The text is well illustrated and easily read, although one must be well equipped mathematically to follow out the experimental procedures. This monograph is highly recommended.

INDUSTRIAL MEDICINE ON THE PLUTONIUM PROJECT: SURVEY AND COLLECTED PAPERS.

Edited by *Robert S. Stone*, M.D., Professor of Radiology and Chairman of Division of Radiology, University of California School of Medicine, San Francisco. National Nuclear Energy Series, Manhattan Project Technical Section, Division IV — Plutonium Project Record, Volume 20. Cloth. Price, $6.25. Pp. 511, with illustrations. McGraw-Hill Book Company, Inc., 330 W. 42nd St., New York 18; Aldwych House, Aldwych, London, W.C.2, 1951.

This recent addition to the National Nuclear Energy Series, which is expected to reach an ultimate total of 60 volumes, deals with the health hazards involved in work with radioactive substances like plutonium. Nineteen contributing authors are listed for this volume. Several chapters describe the health services that have been developed to protect workers from over-exposure, and several more describe the hematological effects of ionizing radiations. Two chapters deal especially with plutonium and one with radium. Of most immediate interest to the practicing physician are the chapters on the treatment of exposed personnel and on the tolerance to whole-body irradiation of patients with advanced cancer.

The book is extremely well organized and clearly written, has ample bibliographic references, and is well indexed.

UNDERSTANDING HEREDITY. An Introduction to Genetics. By *Richard B. Goldschmidt,* University of California. Cloth. Price, $3.75. Pp. 228. John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, 1952.

Understanding Heredity has been written for students who do not intend to specialize in biology as well as for the layman who wants to acquire an elementary knowledge of genetics. The author, Doctor Richard B. Goldschmidt, of the University of California, has presented a short and easily read survey of the basic facts of this intimate and fascinating science. It required a scientist of the order of the author to do this in such an excellent and easy style without sacrificing the accuracy of the text. This was no mean task.

There is an actual need for the instruction found in this volume because of the ridiculous claims made by the so-called Lysenkoism of the Soviet Union. It is important that the thinking people be provided with information which permits them to think for themselves. The chapters included in this book are: 1, hereditary and non-hereditary traits; 2, the sex cells and fertilization; 3, elementary Mendelism; 4, more on elementary Mendelism; 5, chromosomes and Mendelism; 6, linkage; 7, mutation; 8, sex chromosomes and sex-linked inheritance; 9, collaboration of genes; 10, summative or multiple factors; 11, multiple alleles; and 12, a glimpse of more technical facts and problems of genetics. At the close of the book a series of problems to be worked out for each chapter are presented. A list of books is given for further study and finally an excellent glossary of terms is included. The volume closes with an adequate index.

This book is highly recommended to all those who wish to gain an elementary knowledge of this absorbing subject. The reviewer believes that the author's desire to stimulate the student to further and more advanced reading will be accomplished once this fascinating volume is read.

THE STUDY OF INSTINCT. By *N. Tinbergen.* Cloth. Price, $7.00. Pp. 228, with 130 illustrations. Oxford University Press, 114 Fifth Ave., New York 11; Amen House, Warwick Sq., London, E.C.4, 1951.

This book is an extension of a series of lectures delivered under the auspices of the American Museum of Natural History and Columbia University by Professor Tinbergen of Oxford University. The aim of the author is to call attention of Anglo-American workers to research done on the European continent. Most of this work was published in German and little of it has penetrated into English and American science. In addition, the author attempts organization of the ethological problems into a coherent whole and especially to the problems of the causes underlying instinctive behaviour. These problems are dealt with in the first five chapters. The principal aim of Professor Tinbergen in this section has been, first, to elucidate the hierarchial nature of the system of casual relations, and to stress the paramount importance of recognizing the different levels of integration; and second, to bring ethology into contact with neurophysiology. Chapters six to eight inclusive deal with ontogeny, adaptiveness, and evolution. The author states that these chapters were added with considerable hesitation because of the unsatisfactory state of these more or less neglected fields of ethology.

The following is a list of the chapter headings: ethology: the objective study of behaviour; behaviour as a reaction to external stimuli; the internal factors responsible for the spontaneity of behaviour; further consideration of external stimuli; an attempt at a synthesis; the development of behaviour in the individual; the adaptiveness of behaviour; and the evolution of behaviour. A valuable and extensive bibliography is included. The work is well illustrated, indexed, and Professor Tinbergen has made an admirable presentation of his material. The text is written in good concise understandable language. The author undertook and has accomplished a most difficult task. Science is greatly indebted for this splendid contribution.

SIGNS AND SYMPTOMS. Applied Pathologic Physiology and Clinical Interpretation. Edited by *Cyril Mitchell MacBryde,* A.B., M.D., F.A.C.P. Associate Professor of Clinical Medicine, Washington University School of Medicine; Assistant Physician, the Barnes Hospital; Director, Metabolism and Endocrine Clinics, Washington University Clinics, St. Louis, Missouri. Second Edition. Fabrikoid. Price, $10.00. Pp. 783, with 98 illustrations, 50 charts and 8 color plates. J. B. Lippincott Company, East Washington Square, Philadelphia, 1952.

This book is especially designed as an aid to diagnosis. It consists of 31 chapters, covering 783 pages and includes 98 illustrations, 50 charts and 8 color plates. It is the product of 26 contributors. Each chapter covers very adequately a particular sign or symptom and includes the anatomy, pathology, chemistry, physiology and psychology as they are related to the mechanism of sign or symptom under discussion. This the second edition of the work includes new chapters on Pathologic Bleeding, Pigmentation of the Skin, Vertigo and Dizziness, Clubbed Fingers and Hypertrophic Osteoarthropathy. Each chapter is written clearly and concisely and contains much valuable medical information and new techniques as regards the diagnosis of disease. A complete list of references occurs at the end of each chapter. The publishing is good. The book is highly recommended for use by all physicians.

PHYSICAL MEDICINE ABSTRACTS

Iritis as the Presenting Symptom in Ankylosing Spondylitis. M. Q. Birkbeck; W. St. J. Buckler; R. M. Mason, and W. S. Tegner.

Lancet 6688:802 (Nov. 3) 1951.

The syndrome of ankylosing spondylitis can present itself in many ways. Classically it occurs in young males who complain of backache and a stiffness, but it is now known that its early manifestations can be so mild that in some patients medical aid is not sought until ankylosis is well advanced. Other patients may never complain of trouble in the back, and the condition is discovered only incidentally or when the complete rigidity of the back leads to some disaster such as not being able to turn and see the oncoming traffic and being knocked down as a result. That ankylosing spondylitis often is associated with iritis is generally recognized. Most workers who have published series of cases of this condition mention the incidence of iritis among their patients. In a series of patients attending the Department of Physical Medicine at the London Hospital, 13 out of 148 sufferers from ankylosing spondylitis have had iritis. But it is not generally realized that iritis can be the presenting sign of this syndrome, and the authors have recently met no fewer than eleven patients who have been found to be suffering from ankylosing spondylitis when they first sought medical attention for iritis. The iritis which is found in association with ankylosing spondylitis is regarded by ophthalmologists as a nonspecific manifestation of an allergic response. In view of the powerful therapeutic effects of radiotherapy, cortisone, and adrenocorticotropic hormone in ankylosing spondylitis the possibility of a coexisting ankylosing spondylitis should be explored in all patients suffering from nonspecific iritis, so that such spondylitis can be treated as early as possible.

Neurological Changes in Anterior Poliomyelitis and Their Implications in Treatment. Edward B. Schlesinger.

Arch. Neurol. & Psychiat. 66:600 (Nov.) 1951.

The Kenny treatment of acute and subacute anterior poliomyelitis rests in part on unsound physiological concepts. This state is in part due to the neglect of the disease by the neurologist and the misinterpretation of clinical signs by less adroit students of the nervous system. The concept of treatment as being largely a problem in combating muscle spasm is erroneous. The term "muscle spasm" as used in describing clinical patterns in poliomyelitis bears no resemblance to the term as understood by the neurologist. The clinical changes in poliomyelitis represent progressive manifestations of involvement of various parts of the central nervous system and vary strikingly from case to case, depending on the areas affected and the severity of the lesions. Three phases of neurological changes and their implication are described. The fallacy of attempting to treat all phases by a single therapeutic agent, thermal or pharmacological, is discussed. A clinical experiment designed to demonstrate the latter point is described. The author draws the following conclusions: The Kenny method of therapy is sound in respect to its goal of preventing deformity, shortening of muscles, and loss of muscle volume by range-of-motion exercises. The underlying concepts of Kenny doctrine are unsound physiologically and lead to ritualistic and empirical management of the disease process. Members of the medical profession have been quick to improve traditional techniques by adopting some of Kenny's methods, but lamentably uncritical of her concepts. The Kenny and generally medically accepted concepts of "muscle spasm" in poliomyelitis probably are erroneous in physiological terms. "Muscle spasm" actually can be divided into large groups of pathological neural mechanisms of clinical significance. The various entities which are grouped under the name of "muscle spasm" cannot be expected to respond to a single therapeutic agent. Hot packs, muscle relaxants, and such, must be exhibited in proper relation to the mechanisms at play at a given point in the progress of the disease to be of value.

The evidence adduced discounts the value of muscle relaxants during at least one phase of the acute disease.

Roentgen Therapy in Bursitis of the Shoulder: An Analysis of Fifty Cases Using Both Deep and Superficial Techniques. C. M. Witt, and P. F. Titterington.

J. Missouri M. A. 48:870 (Nov.) 1951.

This paper presents the results of fifty consecutive cases of subacromial bursitis. All of the patients represented here are those in whom adequate statistical data was available to evaluate the immediate response to roentgen therapy. Efforts were made to evaluate only the degree of relief of pain since this was the primary aim of treatment. All were patients referred to the authors, as radiologists, for treatment, and all were treated as outpatients. The patients then returned to the referring physician for follow-up care if any was needed. Many forms of therapy have been used in the treatment of bursitis. These include procaine injection, physical therapy in many forms and even a variety of drugs including neostigmine. Some authors have stressed physical therapy during roentgen therapy, to include manipulation under anesthesia, or to follow the relief of the initial pain by roentgen therapy or by other means, with physical therapy. Roentgen therapy has long been recognized as a valuable method in the treatment of bursitis. This therapy is more effective in acute bursitis than in chronic disease. Of the former, 96.2 per cent obtained good results; of the latter only 85.8 per cent. There were many more treatment failures in the chronic group. There would appear to be little significant differences in the use of deep and superficial roentgen therapy, provided adequate penetration is used to reach the site of the disease.

Reflexes Evoked by Cold Stimuli in Injuries of the Spinal Cord. Lewis J. Pollock; Benjamin Boshes; Herman Chor; Isidore Finkelman; Alex J. Arieff; Meyer Brown, and John R. Finkle.

Arch. Neurol. & Psychiat. 65:662 (May) 1951.

Intrigued by the challenge of an article by Macht and Kuhn, in which it is pointed out that there is a paucity of information on the reflexes evoked by cold stimuli in spinal man, Pollock and co-authors studied such responses in their material of injuries to the spinal cord. As was expected, the stimulus of cold, as in the case of other exteroceptive stimuli, produced reflex activity from the distal end of an injured spinal cord. The effectiveness of the stimulus was less than that of scratch or of multiple pinprick. The responses occurred from stimulation of similar reflexogenous zones. As was the case with other stimuli, the greatest number of muscle groups participating in the reflexes occurred with injury of the cervical portion of the spinal cord; next, with injury of the thoracic portion, and least, with injury of the lumbar portion. The greatest number of cases in which no response followed stimulation was that of injuries to the lumbar portion of the spinal cord; next, that of injuries to the thoracic portion, and least, that of injuries to the cervical portion. The frequency of crossed reflexes was least with lesions of the lumbar portion of the spinal cord, next with lesions of the thoracic region and greatest with lesions of the cervical region. Ipsilateral reflexes alone predominated. With lesions of the cervical portion of the spinal cord, abnormal reflex activity in the upper extremities occurred from stimulation of the skin of the upper extremities. The arm and forearm were more effective reflexogenous zones than the hand, and the volar surfaces were more effective than the dorsal surfaces. The arms and forearm were the most effective zones for reflex movements of the shoulder, forearm and wrist; and the hand was the most effective for movements of the thumb and fingers. Ipsilateral and contralateral reflexes of the upper extremities were evoked from stimuli below the level of the lesion, in a few cases as low as the inner aspect of the thigh. Stimulation of the upper extremity resulted in reflex movements of the lower extremities in two instances, representing 5 per cent of 43 cases, whereas stimulation of the abdominal wall resulted in such reflex activity in 18 instances, representing 41 per cent of 43 cases of lesions of the cervical portion of the cord. More reflex activity resulted from stimulation of the upper than of the lower abdominal quadrants.

The Hip Rotator. Guy Beauchamp.

Brit. J. Phys. Med. 14:259 (Nov.) 1951.

A detailed description of a hip rotator is given, with a brief notation of its therapeutic and diagnostic uses. Although the hip rotator was designed primarily to give resistive exercises for the muscles of rotation, active, passive, resisted and assisted movements also may be given. The hip joint can be rotated and mobilized by manual operation of the metal graduated scale. The advantages are readily seen. There is no need to undress, which in itself is a great time-saver, and the patients can, if necessary, put themselves on the machine and carry out the movements, while mobilization needs but a few moments of the physical therapist's time at the end of the exercises. The treatment time averages seven minutes. Limitation in abduction is treated by mobilization of the hip joint in ever-increasing degrees of abduction as measured on the scales on the front of the frame of the machine.

Fractures of the Elbow in Children. Walter P. Blount; Irwin Schultz, and Robert H. Cassidy.

J. A. M. A. 146:699 (June 23) 1951.

Fractures at the elbow joint are very common in children. They follow patterns so remarkably constant that they may be discussed in groups. While each fracture must be evaluated and treated individually, certain general rules may be established. Fractures that can be treated without operation — Aftercare: In the average case the elbow should be immobilized in flexion for about three weeks. At the end of that time the callus is hard enough to allow the elbow to be lowered to a right angle in a sling. In another week or two, all fixation may be discontinued and the child allowed to use the hand at his own discretion. It has been adequately proved that more rapid return of normal function will occur if the child is unmolested. Carrying pails of sand does more harm than good. There should be no manipulation to increase motion either with or without anesthesia. Repeated stretching of contractures not only distresses the child but perpetuates the spasm and delays the return of normal function. Occasionally there is an indication to continue traction until callus is solid. When angular deformity persists at the end of three or four weeks, the fracture may be manipulated under anesthesia and satisfactory position obtained. Bayonet apposition with normal alignment is satisfactory and is not an indication for manipulation at this stage. As in fractures of other long bones, sharp edges round off as growth continues.

Fractures of the medial epicondyle: In a fresh case the fragment should be pinned back in position. The ulnar nerve may be exposed during the operation, but it is rarely injured and may be left in its groove. If operation is not done until two weeks after the injury, it is better to excise the fragment and suture the aponeurosis of the muscle to the humeral condyle. Open reduction and internal fixation performed four weeks or more after the injury are followed by only a fair result and prompt operation by an excellent one. The elbow should be immobilized in right angle flexion for four weeks postoperatively as described for lateral condylar fractures. Fractures of the radial neck: If the displacement is only partial, so that there is some apposition and the angulation is 45 degrees or less, one may be able to manipulate the fragment so as to improve the position. Then the treatment should be conservative. A cast is applied with the elbow flexed to 90 degrees or more acutely. After removal of the plaster, there will be a period of marked disability during which all motions are greatly restricted. Such disability may last for several months. The temptation is great to exercise the radial head in order to increase the range of motion. While the immediate effect is favorable, the late results are tragic. If the operative reduction is delayed or if the fracture is of the comminuted type, considerable new bone will be formed and motion will be restricted for some time. Satisfactory motion will gradually return in most cases. Physical therapy is contraindicated.

Treatment of Acute Subacromial Bursitis. Harry Merliss.

J. M. Soc. New Jersey 48:515 (Nov.) 1951.

The patient with acute subacromial bursitis is usually in such severe pain that treatment must be considered as an emergency procedure. Most of these patients are treated with local Novocain injections with or without irrigation or with x-ray therapy. Some orthopedists advocate immediate surgical exposure and evacuation of the subacromial bursa. No matter what procedure is favored, almost all therapists recognize the value of an immobilizing dressing, the local use of ice and sedation as adjunctive therapy. However, a review of the pathophysiology of acute subacromial bursitis brings out facts that make one wonder whether the primary treatment is not adjunctive and the adjunctive therapy primary. The pathophysiology also points out the self-limited character of acute subacromial bursitis. The rationale of therapy is to relieve intra-bursal tension and reduce the inflammatory response by preventing contusion of the intra-bursal tissues. A critique of existing methods of therapy is given in this discussion together with a case of acute subacromial bursitis that was easily handled with traction, immobilization, ice and Demerol, without more active treatment. A series of seven cases, all treated in the same manner, is presented which shows uniformly good results. Pendulum exercises usually were not started until the seventh day, and motion usually returned rapidly. In one case complete internal rotation remained painful.

Myositis Ossificans Occurring in Poliomyelitis: Report of a Case. W. E. Hess.

Arch. Neurol. & Psychiat. 66:606 (Nov.) 1951.

A review of the literature fails to produce a specific incident of myositis ossificans developing in a paralytic patient whose paralysis was the result of anterior poliomyelitis. Since it is well known that myositis ossificans occurs in more than four per cent of patients with paraplegia from other causes, it would appear that it could occur with poliomyelitic paraplegia. A case is reported which demonstrates this. A seven-year-old girl with anterior poliomyelitis was given treatment consisting of routine physical therapy—daily application of hot packs, muscle reeducation, passive stretching of all taut muscle groups, and bed rest on a firm mattress with a footboard. Use of the hot packs was terminated after six weeks, when all muscular tenderness had subsided. Active and passive physical therapy was then continued. Three months after admission, while undergoing stretchings of the hamstring muscles, the patient sustained an oblique fracture of the right midfemoral shaft. Evidence of a preexisting myositis ossificans was already present, as shown by the immediate postfracture roentgenograms. The process proceeded to ossify and to consolidate further during the period of immobilization of the fracture. The likeliest cause of the myositis ossificans was trauma from overzealous stretching in the treatment of the paralysis. The danger arising from such stretching is emphasized.

Poliomyelitis in Adults in Seattle in 1949. John L. Bakke, and James W. Haviland.

Northwest Med. 50:846 (Nov.) 1951.

The cases of poliomyelitis occurring in adults during one season and observed on a single ward are presented as probably representative of what was occurring simultaneously statewide. This report covers sixty adult poliomyelitis patients admitted to the medical service of King County Hospital in Seattle in 1949. Males predominated in paralytic cases, but very few paralytic cases occurred in the group over thirty-three years of age. It is the general consensus that incidence of poliomyelitis in pregnant women exceeds that in the population at large. Furthermore, they are more susceptible to bulbar paralysis. Although debated by some, it seems fairly well-established that tonsillectomy does predispose to poliomyelitis, especially the bulbar form. Symptoms of headache, stiff neck, malaise and aching of muscles, particularly those of the back and thighs, occurred in virtually all sixty patients. Muscle examinations by the physical therapy department and orthopedic surgeons revealed that fourteen of the nineteen patients with spinal paralysis had predominance of paralysis on the right side and three or five patients with cranio-bulbar paralysis had predominance of weakness on the dominant side. In addition to careful general management, therapy consisted of frequent hot moist packs, bed boards, and appropriate daily physical therapy. Three of thirteen patients had abnormal electrocardiograms. Attempts to isolate poliomyelitis virus from fresh myocardium of a fatal case with clinical evidence of myocarditis were unsuccessful.

Myositis Ossificans with Report of a Case in Paravertebral Muscle. Bennett Creech, and J. U. Gunter.

North Carolina M. J. 12:595 (Dec.) 1951.

Myositis ossificans is characterized by aberrant bony growth within skeletal muscle. Although it is found most frequently near the long bones, myositis ossificans may develop in any of the muscle groups of the body. However, Creech and Gunter were able to find only two cases involving paravertebral muscle. Prophylactic treatment of myositis ossificans includes avoidance of massage, the application of cold compresses or ice packs, and the use of a compression bandage immediately after injury in order to reduce hemorrhage. Thorndike states that evacuation of a hematoma in its early stages is contraindicated. The best treatment consists of rest, followed in a minority of cases by surgical excision when necessitated by symptoms of a mechanical nature persisting in its mature stage.

The Orthopedic Management of Arthritis. Peter L. Carnesale, and Mark W. Garry.

Am. Pract. 2:840 (Oct.) 1951.

Complete and proper management of arthritis should consist of medical, physical therapy, psychiatric and orthopedic measures. The orthopedist often includes the physical therapy measures as part of the treatment; and the physician, the psychiatric. Medical treatment alone will not suffice for the severe arthritic and neither will orthopedic treatment alone. It is essential that everyone treating arthritis should know and understand the simple orthopedic principles which are involved in the management of arthritis. Function in arthritis may be preserved when the following factors are taken into consideration during treatment: (1) Rest — mechanical and physiologic; (2) immobilization and mobilization; (3) optimal position of rest and function; (4) prevention of deformity; (5) physical therapy — modalities and application, and (6) maintenance of normal body posture.

The use of physical therapy is a field in itself and is not stressed in this paper. The function of a joint will often return spontaneously after the acute symptoms have subsided. Function will improve more rapidly with the use of proper physical therapy and rehabilitation, using means such as heat in its various forms and massage followed by motion under supervision. Close observation to note reaction to treatment is necessary. Reappearance of swelling, heat and pain may mean the treatment is too vigorous. It should be stopped until symptoms subside and then resumed with less vigor. If there is no reaction, more intensive treatment is encouraged. Each patient must be handled individually in this regard Whirlpool or paraffin baths, heat and gentle massage, are recommended prior to attempted motion. This therapy should be done under the supervision of a physical therapist or at least by one who has the patience, time, and knowledge that is required. How long one should continue this treatment depends upon the patient; no two are the same. Supervised motion and physical therapy should continue as long as increase in motion is noted. The splints should be used especially at night for as long as one suspects that contractures may develop without the splints. However, if the patient is afebrile, the sedimentation rate is normal or approaching normal and the patient is responding to physical therapy, the splints should gradually be dispensed with but the patient also should be closely observed. If it is noted that there is a recurrence of a contracture, the splints should again be resumed.

Treatment of Parkinson's Syndrome: Some Practical Considerations. Joseph C. Yaskin.

Pennsylvania M. J. 54:1156 (Dec.) 1951.

Parkinson's syndrome is a condition characterized by increased tone of the voluntary, and to a lesser extent, involuntary muscles, resulting in slowing up of various voluntary movements, and accompanied by characteristic changes in posture, gait, movements of the limbs, speech, and often accompanied by involuntary movements of a characteristic type. The course of the disease varies considerably. Some unilateral Parkinson cases may remain in a state of relative usefulness for many years. Others become markedly incapacitated in a short time. However, the prognosis and course of Parkinson's syndrome can and should be modified by well-considered management. It has long been recognized that rest, so necessary in the treatment of many diseases, is not helpful in Parkinson's syndrome. The individual should be encouraged to keep up his usual physical activities, and he should be warned that immobilization in the case of Parkinson's disease is a part of a vicious circle. The physician should keep in mind that physical inertia is a part of the disease, especially so in postencephalitic parkinsonism, where drowsiness is not uncommon. On the other hand, it should be remembered that violent physical exercise tends to increase muscle rigidity and should be discouraged. Physical therapy under the guidance of trained personnel, is unquestionably helpful in preventing or at least retarding invalidism.

Effects of Temperature of Local Baths on Deep Muscle Temperature. R. N. Danielson, and F. W. Kinard.

J. Applied Physiol. 4:373 (Nov.) 1951.

Many measurements of tissue temperatures, both in man and in other animals, have been made by various workers. Nevertheless, when curiosity arose as to the extent to which the muscles of an extremity might be warmed or cooled by immersion of the limb in a water bath, very few pertinent data could be found in the available literature. This study showed that immersion of the limb of the dog in a water bath at a temperature higher or lower than that of the extremity leads to a prompt and marked change in the deep muscle temperature of the limb in the direction of the bath temperature. This change in muscle temperature is enhanced by occlusion of the circulation. Rectal temperatures are affected in the same direction but to a lesser extent when the circulation is intact, but are unaffected when the circulation is occluded. At an elevated bath temperature, irreversible damage to tissues may be produced when there is interference with the circulation, although no damage appears under similar conditions when the circulation is intact.

Some Clinical Applications of Ergography. F. A. Hellebrandt, and Sara Jane Houtz.

J. Bone & Joint Surg. 33-A:968 (Oct.) 1951.

No branch of medical practice is called upon more frequently than orthopedics for the purpose of evaluating the magnitude and the functional significance of disabilities affecting the neuromuscular and skeletal systems. The merits of objectivity in disability evaluation are self-evident, especially when the evaluation is to be used in the adjudication of compensation claims due to industrial injuries or to injuries sustained during service in the armed forces. Such disability evaluation usually is based, as it should be, upon the judgment of the examining physician. Although no instrument can replace the knowledge, skill, and insight of the experienced observer, many of the basic components of physical demands and capacities analysis are amenable to direct measurement. When these are appraised quantitatively, the objective evidence obtained serves as a valid and reliable guide to the examiner and lessens the burden of proof in much the same way that an electrocardiogram may be used to sustain the view of an internist. The period since the onset of World War II has witnessed the evolution of what Rusk has aptly called the third phase of medical practice — dynamic convalescent care which bridges the gap between the end of definitive treatment and the restoration of maximal residual function. His concept has focused increasing attention on the social and economic advantages of utilizing remaining abilities for industrial purposes by the selective placement of impaired workers. Before this can be done, facilities for, and techniques of treatment must be available for the full physical restoration of the disabled. This is the most important step in rehabilitation. Functional capacities must then be assessed in order to match the patient's abilities with the demands of job assignment. The merits of ergography in relation to the evaluation of disability, the quantification of exercise dosage, and the objective measurement of progress should be considered. Ergography may be useful as a guide to the medical examiner in the evaluation of the functional status of the orthopedically disabled at the onset of treatment, the critical appraisal of end results, the determination of the end point of effective rehabilitation, and the magnitude of residual dysfunction. Although adequate management of the patient usually requires no specialized techniques to evaluate functional status, high degrees of precision in measurement are sometimes desired. Objective testing then has special merit; it enables the examiner to support his deductions with demonstrable evidence.

Pedogogical and Performance Factors of Manual Artificial Respiration with Naval Personnel—V. Archer S. Gordon; Shirley Star; Fred Meier; Creighton Hale, and A. C. Ivy.

J. Applied Physiol. 4:447 (Dec.) 1951.

Observations and rating of the performance of methods of manual artificial respiration by 667 naval recruits and 124 Waves revealed that both the arm-lift back-pressure and variations of the hip-lift back-pressure can be successfully taught to naval recruits in relatively brief training sessions as used in this test. Of these methods, the arm-lift back-pressure surpasses all the variations of the hip method in accuracy of performance, ease of learning — as measured by the need for an amount of correction — and physical ease of performance. Among the hip methods, the hip-lift back-pressure, especially when an adjunct is used in its performance, is most easily learned and accurately performed. However, it is physically harder to do than the hip rolls. Hip methods, unlike the arm method, result in greater fatigue for the operator when the subject is appreciably larger than the operator.

RESOLUTION APPROVED

The report of the Council on Medical Education and Hospitals of the American Medical Association was approved by the Advisory Board of Medical Specialties at its business meeting on February 10, 1952. Included in this report was the following Resolution:

"Whereas, An emergency medical call service is of proven value both as a community public service and as a means of good public relations between a physician and his community; and

'Whereas, Participation in such a service is not onerous if many physicians cooperate; and

"Whereas, Every County Medical Society has been asked to operate such an emergency service; therefore be it

"Resolved, That every doctor below the age of 35 years, regardless of his type of practice, be urged to participate in his community's call plans; and be it further

"Resolved, That all national specialty boards be requested by the Secretary of the American Medical Association to facilitate such general participation by assuring their members and potential members that they may participate in such a community activity without jeopardy to specialty ratings.

"Amendment —

"Resolved, That all national specialty boards be requested by the American Medical Association to facilitate such general participation by assuring their members and potential members that they may participate in such a community activity without jeopardy to specialty ratings."

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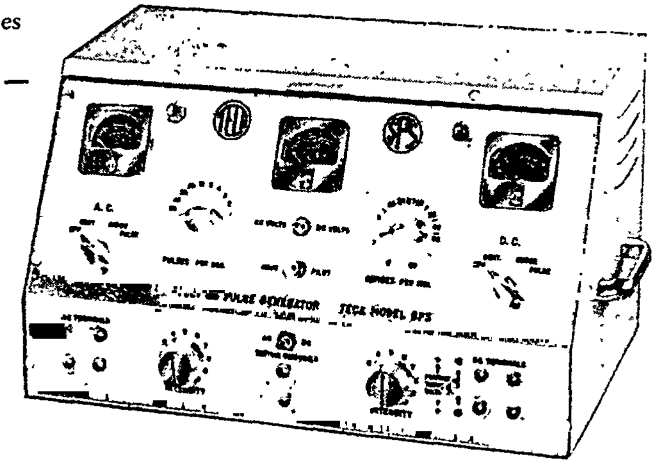

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Contents—Nov. 1952

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ORIGINAL ARTICLES

The Second John Stanley Coulter Memorial Lecture. Report on the International Congress of Physical Medicine. Frank H. Krusen, M.D. 651

The Effect of Ultrasound on the Transmissible Walker Rat Carcinoma. James D. Schroder, D.V.M.; J. F. Herrick, Ph.D., and Alfred G. Karlson, Ph.D. 660

Relaxation of Spasticity by Electrical Stimulation of Antagonist Muscles. Milton G. Levine, Ph.D.; Margaret Knott, B.S., and Herman Kabat, M.D. 668

Electrical Stimulation in the Treatment of Intractable Stress Incontinence. J. W. Huffman, M.D.; S. L. Osborne, Ph.D., and J. K. Sokol, M.D. 674

Biophysical Basis for the Selection of Functional Back Braces. Odon F. von Werssowetz, M.D. 676
Discussed by Dr. Robert W. Boyle.

A Portable Electronic Pulse Detector. Henry Fleck, M.D. 686

●

Medical News 688

●

Editorials 689

●

Book Reviews 692

●

Physical Medicine Abstracts 695

●

EDITOR OF THE MONTH

GEORGE MORRIS PIERSOL, M.D.
Philadelphia, Pa.

Printed in U.S.A.

RESOLUTION APPROVED

The report of the Council on Medical Education and Hospitals of the American Medical Association was approved by the Advisory Board of Medical Specialties at its business meeting on February 10, 1952. Included in this report was the following Resolution:

"Whereas, An emergency medical call service is of proven value both as a community public service and as a means of good public relations between a physician and his community; and

'Whereas, Participation in such a service is not onerous if many physicians cooperate; and

"Whereas, Every County Medical Society has been asked to operate such an emergency service; therefore be it

"Resolved, That every doctor below the age of 35 years, regardless of his type of practice, be urged to participate in his community's call plans; and be it further

"Resolved, That all national specialty boards be requested by the Secretary of the American Medical Association to facilitate such general participation by assuring their members and potential members that they may participate in such a community activity without jeopardy to specialty ratings.

"Amendment —

"Resolved, That all national specialty boards be requested by the American Medical Association to facilitate such general participation by assuring their members and potential members that they may participate in such a community activity without jeopardy to specialty ratings."

CHICAGO SOCIETY OF PHYSICAL MEDICINE AND REHABILITATION

Wednesday, December 3, 1952

Dinner, 6 P. M., Pizzeria Napolitana, 907½ Taylor Street, Chicago.

Scientific Session, 8 P. M., Room 106, University of Illinois Research and Educational Hospitals, 1819 W. Polk St.

Subject: "Physiological Devices for the Facilitation of Work Output in the Rehabilitation of the Disabled." Dr. Frances Hellebrandt.

Make reservations with the Secretary, Dr. Milton G. Schmitt,
6970 N. Clark St., Chicago 26.

The Second John Stanley Coulter Memorial Lecture

REPORT ON THE INTERNATIONAL CONGRESS OF PHYSICAL MEDICINE *

FRANK H. KRUSEN, M.D.
Section of Physical Medicine and Rehabilitation

Mayo Clinic, Rochester, Minnesota

It is a signal honor to have the privilege of rendering homage to the memory of a distinguished pioneer and inspiring leader in physical medicine and rehabilitation, John Stanley Coulter. It was my good fortune to work very closely with John Coulter for many years prior to his untimely death. His complete lack of affectation, his zeal for the advancement of our discipline, his ready good humor and his genius for leadership and diplomacy endeared him to all of us.

Supreme among his interests was his constant concern for the forward progress of our branch of medical practice. I have a vivid memory of his exultation whenever the specialty made another step forward. I recall, as if it were yesterday, how he beamed with delight when we were informed that the establishment of an American specialty board in physical medicine and rehabilitation had been approved. I know, therefore, how very greatly he would have been gratified to hear this report of still another tremendous stride forward, this time on an international scale.

On July 13, 1952, at King's College, London, England, representatives of associations of physical medicine from fifteen nations convened and formally constituted the International Federation of Physical Medicine (with membership in the Council for Co-ordination of International Congresses of Medical Sciences). The national associations of physical medicine which became founder members and the chairmen of their delegations were as follows: Argentina, Dr. O. Rosenberg; Australia, Dr. B. G. Wade; Austria, Dr. V. E. Klare; Belgium, Prof. J. Michez; Canada, Dr. G. Gingras; Denmark, Dr. S. Clemmesen; Germany, Prof. R. Schulze; Great Britain, Dr. W. S. Tegner; Holland, Dr. D. J. van Bosveld Heinsius; Israel, Dr. E. Adler; Norway, Dr. O. Mellbye; Spain, Dr. J. M. Poal; Sweden, Dr. A. Gjertz; Switzerland, Dr. V. R. Ott, and United States of America, Dr. W. J. Zeiter. Furthermore, during the meeting, the national associations of physical medicine of the following countries were accepted provisionally for membership in the Federation: France and Yugoslavia.

Observers from the following countries, which have no associations of physical medicine, also attended the meeting of the International Federation: Cuba, Dr. J. I. Tarafa; Egypt, Dr. Salama-Bey; Eire, Dr. Mary O'Donnell; Italy, Dr. Villani, and Portugal, Dr. F. Formigal Luzes.

Likewise representatives from two other countries, who were unable to attend, expressed a desire to support and participate in the future activities of the Federation. These were: Brazil, Dr. Waldemar Bianchi, and Chile, Dr. Ernesto Saldias. Thus the associations of fifteen nations became founder members of the Federation, the associations from two other nations were given provisional membership, and seven additional nations sent observers or expressed a desire to support the Federation.

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* Presented at the meeting of the American Congress of Physical Medicine, New York, New York, August 27, 1952.

Dr. Frank Krusen (United States of America) was elected first president of the Federation, Dr. Philippe Bauwens (Great Britain) was elected the first honorary secretary, and Dr. Hugh Burt (Great Britain) was elected the first honorary treasurer. Subsequently Dr. A. T. Richardson (Great Britain) was appointed assistant secretary. The permanent offices of the Federation were established in London with the understanding that the location of these offices would be reconsidered at the time of the next congress. It was agreed that full membership in the congresses of the Federation should be restricted to qualified physicians and surgeons. An executive committee to conduct the business of the Federation between congresses was elected. This committee consists of the following members: Lord Horder (Great Britain), president of the Federation; Dr. Frank Krusen (United States of America), past president of the Federation; the president of the forthcoming congress (Denmark); the honorary secretary of the forthcoming congress (Denmark); Dr. A. C. Boyle (Great Britain), honorary secretary of the preceding congress; the honorary treasurer of the forthcoming congress (Denmark); Dr. Philippe Bauwens (Great Britain), honorary secretary of the Federation; Dr. Hugh Burt (Great Britain), honorary treasurer of the Federation; Dr. O. Rosenberg (Argentina); Prof. J. Michez (Belgium); Dr. Svend Clemmesen (Denmark); Dr. V. R. Ott (Switzerland), and Dr. W. J. Zeiter (United States of America).

It was voted unanimously that each member association should be asked to pay an annual subscription to the Federation of 2 shillings sterling (approximately 28 cents) per individual member of their association. It was agreed that hereafter the Federation should have three official languages: French, English and Spanish. The following properties and insignia were received by the Federation: ceremonial lamp (presented by Lord Horder), gavel and block (presented by Mrs. Richard Kovács, and presidential badge (presented by Mr. Bernard Baruch). It was agreed that the next International Congress of Physical Medicine should be held in Denmark in 1956.

Following this important organizational meeting, there was a reception given by the ladies committee of the congress in the Council Room of King's College. All members and social associate members were invited to attend this delightful reception. On Sunday evening, July 13, Dr. and Mrs. Francis Bach of London gave at their home an enjoyable buffet supper and reception for the delegates to the Federation and their wives. All of the guests seemed greatly to appreciate the hospitality of our host and hostess.

On Monday, July 14, the impressive opening ceremony was held at 11 a. m. in the Great Hall of King's College (fig. 1). The speakers and guests of honor were robed in academic costumes and following the colorful procession, Marshal of the Royal Air Force, the Lord Tedder, G.C.B., gave the opening oration and lit the ceremonial lamp presented previously by Lord Horder. Then as president of the Federation, it was my privilege to install Lord Horder as president of the congress for 1952 and to invest him with the presidential badge, presented previously by Mr. Bernard Baruch. Lord Horder then assumed the chair and called the congress to order with the gavel and block presented previously by Mrs. Richard Kovács. Speeches of welcome were given on behalf of Her Majesty's Government by the Right Honorable Iain N. Macleod, minister of health and, on behalf of the International Federation of Physical Medicine, by Dr. Frank Krusen, president of the Federation. Replies were tendered by Dr. Svend Clemmesen of Denmark and by Dr. Max Walthard of Switzerland. Then the Right Honorable Lord Horder, G.C.V.O., gave his excellent presidential address and the ceremonies were closed with a vote of thanks to Lord Tedder by Dr. Frank Howitt of Great Britain.

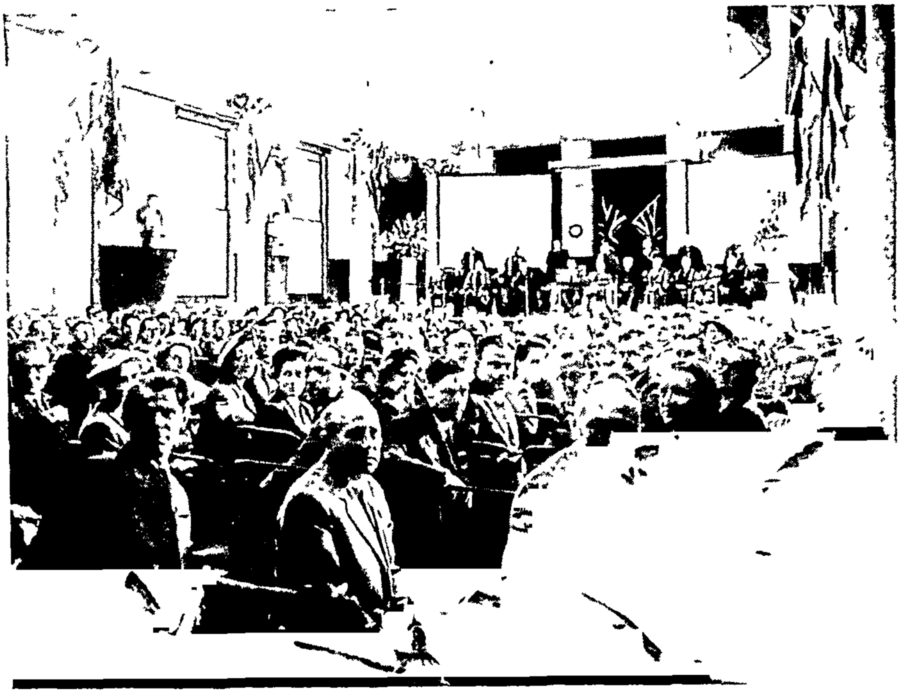

Fig. 1. — Opening ceremonies of the International Congress of Physical Medicine. The Great Hall, King's College, England, July 14, 1952.

The superb timing and beautiful pageantry of this opening ceremony inaugurated the meetings of the congress in most auspicious fashion. Following the recession, there was a reception in the robing room at King's College which was tendered by the American delegation to the speakers and guests of honor.

In the afternoon at 2:30 p. m., in my capacity as president of the Federation, I accompanied the president of the congress, Lord Horder, during the opening of the exhibitions. On an upper floor of King's College, there were an excellent scientific and historical exhibition and also a well-organized trade exhibition arranged under the able direction of Dr. Clive Shields. The American scientific exhibitors included A. A. Rodriquez, D. A. Schram, H. A. Rusk, and J. E. Markee. Of particular interest among the British exhibits were a kitchen unit designed for the disabled housewife and presented by Frank Cooksey, a display of electronic equipment presented by Philippe Bauwens, and an exhibit on the history of physical medicine presented by the Wellcome Historical Medical Museum of Great Britain. The trade exhibition included the display of equipment from Great Britain, Austria and Germany. Electrodiagnostic devices, variable-frequency apparatus, ultrasonic-therapy equipment, short-wave-diathermy machines, microwave-diathermy apparatus and textbooks on physical medicine were included in this display. It was gratifying to find so much new and well-constructed European equipment available.

At 3 p. m. on Monday there was presented in the Great Hall at King's College a symposium on "Developments in Physical Medicine in the Past Decade." F. D. Howitt described the development in Great Britain, F. H. Krusen outlined the progress in the United States of America, S. Clemmesen detailed the advances in Denmark, and V. E. Klare reported on the struggles for progress in Austria. It was the consensus of these physicians that World War II has stimulated the development of physical medicine. Our discipline has progressed from a therapeutic to a clinical specialty. Thorough diagnosis and rational prescription of treatment are essential. Physical medicine has progressed from empiricism to precision in diagnosis and treatment. There has been a remarkable increase in laboratory and clinical research in this field. There is a growing program of teaching of physical medicine in the universities. The value of rehabilitation programs in various hospitals is being increasingly recognized. Contacts between various nations concerning advances in physical medicine are developing rapidly. A vigorous new medical specialty, which emphasizes research and the clinical aspects of practice, has come into being during the past decade. The international picture which these four speakers presented was a most encouraging one.

During this same afternoon, the social associate members were provided with a tour of the Zoological Gardens in Regents Park. Following the scientific session, the official photograph of the congress was made. Then from 6 to 8 p. m., Her Majesty's Government held a reception for the members and associate members of the congress at Lancaster House, St. James. The Right Honorable Iain Macleod, minister of health, received the guests. The reception in this magnificent official residence was a most enjoyable occasion. Still, for many of us, this amazingly well-organized and fascinatingly interesting first day of the congress was not complete. The president and council of the Royal College of Surgeons of England tendered a dinner to all the national representatives of the International Federation at the Royal College of Surgeons, Lincoln's Inn Fields (fig. 2).

Fig. 2. — Dinner tendered to the delegates to the International Federation of Physical Medicine by the President and Council of the Royal College of Surgeons. Lincoln's Inn Fields, London, England, July 14, 1952.

Our host, Sir Cecil Wakeley, president of the college, greeted us and finally, preceded by his mace bearer, led us to the dining hall. Following this delightful and friendly dinner, there was a toast to Her Majesty the

Queen and the members of the royal family. Sir Cecil then proposed a toast to the International Federation to which I responded as president of the Federation. Then Sir James Paterson Ross, senior vice-president of the Royal College of Surgeons, proposed a toast to the International Congress of Physical Medicine and replies were given by Lord Horder and by Dr. Svend Clemmesen of Denmark. All of our delegates were deeply appreciative of the hospitality shown by our hosts, and following the dinner, they enjoyed particularly a visit to the museum of the college where they viewed the interesting relics of the investigations of John Hunter and of the early surgical activities of Lord Lister. Of especial interest to many of the guests was a recent acquisition, the collection of "Belsen hearts." These were hearts of people who had died of starvation in Belsen prison camp. Amazingly they were approximately only one-fifth the size of normal hearts! We were profoundly shocked by this tragic evidence of extreme starvation and of man's inhumanity to man.

On Tuesday morning, July 15, E. Grandjean (Switzerland), and W. Tegnar (Great Britain) presented valuable discussions on physical education and then the members of the congress traveled by bus to Aldershot where we lunched. In the afternoon our group observed interesting demonstrations, by Mr. A. H. Gem, of physical education and conditioning of London school children, and exhibitions of conditioning and remedial exercise programs for groups of Army recruits, presented by Brigadier R. H. L. Oulton and Lt. Col. J. B. M. Milne, as well as demonstrations of standard tests and battle physical training. While our members were visiting Aldershot, the social associate members were making an equally interesting visit to Windsor and Windsor Castle. On Tuesday evening the members and social associate members of the congress were entertained by the Worshipful Society of Apothecaries of London at a reception in the Ancient Apothecaries Hall, which was built in the tenth century and was once occupied by the Black Friars. Our host and hostess on this occasion were Dr. and Mrs. Frank Howitt. Dr. Howitt is vice-chancellor of the time-honored Apothecaries Guild, and all the guests enjoyed seeing this tradition-laden building with its many fine old pictures including one attributed to Valesquez and another to Holbein.

On Wednesday morning, July 16, H. A. Rusk (United States of America), P. Houssa (Belgium) and F. S. Cooksey (Great Britain) participated in a symposium on rehabilitation and resettlement in the Great Hall at King's College. This symposium was followed by a forum under the chairmanship of H. Balme (Great Britain). The speakers of the morning participated as did also R. L. Bennett (United States of America), C. J. S. O'Malley (Great Britain), and W. J. Zeiter (United States of America). It was the consensus of the speakers at this symposium and forum that rehabilitation has become established as a new medical discipline which aims at restoration of the physically handicapped person to normal life; that physicians should avoid an attitude of hopelessness or passive acceptance in the face of chronic illness or disability; that a dynamic approach to chronic illness frequently results in restoration of the chronically ill patient to a fair measure of self-sufficiency, self-respect and happiness; that physicians should be interested not only in adding years to life but also in adding life to years; and further that in the approach to the management of disabling conditions, the physician should always consider the psychologic as well as the physical problems. It was brought out that rehabilitation aims at returning the handicapped individual to a normal living and working environment or to the most suitable alternate conditions possible; it is inextricably conjoined with physical medicine and may be defined as the preparation of the patient physically, mentally, socially and vocationally for the fullest possible life compatible with his abilities and disabilities.

In the afternoon there were two important sessions: one was a symposium on various aspects of rehabilitation and the other was a symposium on the management of poliomyelitis, followed by papers on treatment of cerebral palsy and geriatric rehabilitation. In the symposium on rehabilitation, eight papers provided extensive coverage of many aspects of the subject. Henry Kessler (United States of America) mentioned that many minds and skills meet on the rehabilitation team which under the leadership of the medical director consists of physicians, nurses, therapists and counsellors. T. M. Ling (Great Britain) pointed out that the psychologic aspects of rehabilitation should be understood not only by physicians but also by governmental agencies, employers and the public. A. B. C. Knudson (United States of America) indicated that the accomplishment of rehabilitation objectives produced tremendous economic savings. The other speakers in this symposium included V. A. Porsman (Denmark), G. H. Fisk (Canada), A. J. Martin, and R. Harris (Great Britain), G. Gingras (Canada), and C. B. W. Parry (Great Britain). They were in general agreement with the previous speakers of the day concerning the importance of modern rehabilitation procedures.

In the other session of the afternoon there were also eight papers. R. L. Bennett (United States of America) discussed the use of splints, corsets, supports, braces and crutches as an essential phase of convalescent care of poliomyelitis. H. E. Weiser (Israel) advocated the intensive use of progressive power exercises for young children having poliomyelitis. M. E. Knapp (United States of America) presented a follow-up study on 391 patients who had poliomyelitis. Also included were papers by Kottke, Kubicek and Olson (United States of America) on vasomotor activity in the feet following poliomyelitis; by F. F. Luzes (Portugal) on physical treatment of poliomyelitis; by Mary O'Donnell (Eire) on treatment of cerebral palsy; by L. Cosin (Great Britain) on geriatric rehabilitation; and by E. F. Wadge (Great Britain) on geriatric rehabilitation. Also during this afternoon a variety of scientific motion pictures dealing with various phases of physical medicine and rehabilitation from Canada, Cuba, Great Britain and the United States were shown. Meanwhile during this busy day, the social associate members had attended a style show in the morning and paid a visit to Hatfield House in the afternoon.

On Wednesday evening, there were two receptions: one by the Ciba Foundation and another tendered jointly by the Empire Rheumatism Council and the Heberden Society. Both were particularly pleasant occasions and the members were shown once more how exceedingly warm and cordial British hospitality can be.

On Thursday morning, July 17, the scientific session consisted of a morning symposium on "The Management of Chronic Rheumatism and Other Disorders of the Locomotor System" followed by a forum on this subject. F. D. Hart (Great Britain) expressed the belief that rehabilitation of chronic rheumatic disorders could be achieved more readily with proper use of corticotropin, cortisone and hydrocortisone. He warned, however, of potential dangers when these agents were administered, and advocated their use only in selected cases under careful supervision. L. J. Michotte (Belgium) discussed "low backache" and concluded that it was commonly the result of irritation of the spinal ganglions of the first, second and third lumbar nerves. H. A. Burt and his associates (Great Britain) discussed the painful shoulder and concluded that physical therapeutic measures are definitely indicated in its management. During the succeeding forum under the chairmanship of F. D. Howitt (Great Britain), the speakers of the morning were joined by W. S. Tegner (Great Britain) and K. M. Walthard (Switzerland). A lively discussion ensued which indicated definitely the continuing importance of physical medicine and rehabilitation in chronic rheumatic disorders.

During the afternoon a series of papers on the topic of the morning was presented. J. Michez (Belgium) discussed the physical treatment of rheumatoid arthritis and emphasized its importance. He stated that a complete department of physical medicine must exist in every center for rheumatic diseases. E. W. Lowman (United States of America) discussed rehabilitation of the chronic rheumatoid arthritic derelict. He recommended that during prolonged cortisone therapy the dose be kept below 75 mg. per day. He added that while increase of muscular power and range of motion of joints is important, the real objective of rehabilitation is functional training toward proficiency in activities necessary for self-sufficient living. H. Petty (Great-Britain) discussed the orthopedic aspects of rheumatoid arthritis, and F. Bach (Great Britain) concluded that by using cortisone wisely the specialist in physical medicine can often treat rheumatoid arthritis with less discomfort and achieve his aim more quickly with fewer setbacks. The other papers of the afternoon included discussions of treatment of osteoarthritis of the hip by W. A. Fell (Great Britain), of a device for cervical traction by J. M. Poal and J. F. Condominas (Spain), of studies on permeability of synovial membrane by W. D. Paul and J. I. Routh (United States of America), and of after-care of acrylic-head arthroplasties of the hip by O. Troisier (France).

Also on Thursday afternoon, in another lecture hall, a series of general papers on various aspects of physical medicine was presented. R. Harris and his associates (Great Britain) reported on a study of circulatory changes in skin and muscle during reflex heating. It was emphasized that changes in temperature of the skin provide no indication of the circulation in underlying muscles. J. H. Aldes (United States of America) discussed ultrasonic treatment of osteoarthritis of the cervical and lumbosacral regions of the spinal column. V. R. Ott (Switzerland) concluded that certain systemic heat treatments produce activation of the pituitary-adrenal system while others produce a cholinergic (parasympathetic) effect. R. Schulze (Germany) discussed secondary pigmentation following ultraviolet irradiation, M. Fuchs (Switzerland) described the "syncardial method" of treating peripheral vascular diseases, A. Stoddard (Great Britain) discussed the short-leg and low back syndrome, and L. J. Michotte (Belgium) advised resection and modeling of the distal end of the clavicle in management of osteoarthritis of the acromioclavicular joint.

Also on Thursday afternoon another series of scientific motion pictures from Canada, Belgium, Great Britain, Spain and the United States was presented. On this same day the social associate members visited Hampton Court.

On Thursday evening the members of the congress and the social associate members attended a formal reception at the Royal Institution of Great Britain where we were received by the president, Lord Brabizon, viewed the equipment employed by Michael Faraday and Sir Humphrey Davy in their early researches, and then listened to a fascinatingly interesting lecture and demonstration on "Physics and Medicine" by Prof. E. N. da C. Andrade. Professor Andrade's lecture was so scholarly that it was appreciated by physicians and physicists alike, and so skillfully and clearly presented that even the least scientific lady could enjoy it thoroughly. Everyone agreed that this was a most inspiring evening.

On Friday morning, July 18, the scientific session was devoted to a symposium on electrodiagnostic methods followed by a forum on this subject. J. Lefebvre (France) discussed the value of chronaxie in electrodiagnosis. He concluded that chronaxie measurement is a convenient method of calculating the speed of excitability. E. Kugelberg (Sweden) concluded that electromyography had become an indispensable routine method of diagnosis in hospitals admitting large numbers of patients having neuromuscular disorders. P. Bauwens (Great Britain) described technical advances in electrodiagnosis. He concluded that electronic generators of rectangular pulses of variable durations can be of the current-stabilized or voltage-stabilized pattern, and expressed the belief that the two machines are equally reliable in expert hands. During the ensuing forum under the chairmanship of F. H. Krusen (United States of America), the speakers of the morning were joined by S. Clemmesen (Denmark), and F. S. Cooksey (Great Britain). Many questions were asked of the experts on electrodiagnosis, and it was apparent that electromyography is becoming an extremely important diagnostic procedure.

On Friday afternoon a series of papers on physical measures in diagnosis and treatment was presented. A. Lundervold (Norway) described an electromyographic investigation of muscular fatigue in man. It was concluded that muscular fatigue is caused by the fact that the restitution phase in the muscle cells becomes too long in proportion to the time available, so that contractibility is reduced. C. B. W. Parry (Great Britain) discussed electrodiagnostic methods in peripheral nerve injuries and concluded that the strength-duration curves and electromyography are of considerable value in the diagnosis of, and assessment of recovery from, peripheral nerve injuries. B. O. Scott (Great Britain) described a cross-fire technique with short-wave diathermy. Two machines having slightly different frequencies were used. When a cross fire was applied to phantoms with these two machines, heating appeared first at the center and then spread to the periphery. J. B. Millard (Great Britain) discussed electrical stimulation in rehabilitation of knee injuries and concluded that it was of no value in overcoming wasting of the quadriceps muscle or in accelerating the disappearance of effusion. K. Woeber (Germany) reported on studies of the effects of ultrasonics, ultrashort waves and hyperthermia on the mitosis of Walker carcinoma. Quantitative and qualitative irregularities of mitosis were observed in each instance.

Finally, at 4:15 p. m., we came to the closing scientific session of this remarkably interesting international congress. Lord Horder, president of the congress, presided. H. A. Rusk (United States of America) gave an inspiring talk on physical medicine and rehabilitation as a service to medicine and the community. He advocated "total treatment for the disabled patient in terms of his whole problem," and recommended that the hospital should be the center of community rehabilitation services. He concluded that with dynamic programs of rehabilitation the traditional sequelae of physical disability may often be prevented and the individual trained to live and to work with what he has left. Next H. Balme (Great Britain) gave an oration on rehabilitation and international economy. He concluded that a serious international attack on physical disability depends on recognition of interested countries, adequately staffed departments of physical medicine and rehabilitation, early diagnosis of potential disability, expert medical treatment, social and psychologic aids and appropriate vocational opportunity. Then

Philippe Bauwens, secretary of the Federation, gave hs fiinal report concerning the meeting of the International Committee. Frank Krusen, president of the Federation, followed with his final remarks as retiring president. He announced that he had appointed a committee consisting of P. Bauwens (Great Britain), chairman; L. J. Michotte (Belgium), and K. M. Walthard (Switzerland) to settle problems of terminology and conflicts concerning variations in the meaning of words in the three official languages of the Federation. He announced the appointment of A. T. Richardson (Great Britain) as assistant secretary of the Federation and also announced the provisional acceptance of the associations of physical medicine of France and Yugoslavia as members of the Federation. He expressed warm admiration for and deep gratitude to Philippe Bauwens, chairman, and A. C. Boyle, honorary secretary of the congress, and the other members of the British board of management for their superb organizational arrangements and unbounded hospitality. Finally he announced that he was passing on the torch to Lord Horder who at the close of this meeting would retire as president of the congress and automatically succeed to the presidency of the Federation. Lord Horder closed the ceremonies with friendly remarks to his colleagues and thanks to his able associates and snuffed out the ceremonial lamp, to indicate the closing of the scientific sessions of the congress, and announced that it would be lit again in Copenhagen in 1956.

While these scientific sessions were drawing to a close, the social associate members had spent a pleasant day in an excursion to the Royal Naval College and National Maritime Museum at Greenwich. But still this magnificent congress had not ended, British hospitality had not ceased, and the final climax was yet to come. On Friday evening an impressive formal banquet was held at the Dorchester with many distinguished guests in attendance (fig. 3). Following this delightful dinner, the toast to Her Majesty the Queen was proposed by Lord Horder and a toast to the congress and Federation was

Fig. 3. — Banquet of the International Congress of Physical Medicine. The Dorchester, London, England, July 19, 1952.

proposed by Sir Lionel Whitby, chancellor of the University of Cambridge. The reply was made by Lord Horder. A toast to the guests was proposed by Dr. Frank Krusen, retiring president of the Federation, and replied to by Sir Walter Russell Brain, president of the Royal College of Physicians. A warm feeling of friendship and international amity spread among the 350 guests, representing twenty-two nations, who attended this banquet and who remained to exchange friendly farewell greetings during the congress ball which followed. Everyone seemed convinced that physical medicine and rehabilitation had made another tremendous stride forward and that there was promise of enormous gains in exchange of ideas and promotion of scientific investigation among the physicians of the many nations which were represented.

I quote the report concerning this congress which appeared recently in the London *Lancet*:[1] "The congress demonstrated that physical medicine has been accepted as a specialty within general medicine. . . . The speeches of Sir Cecil Wakeley and Sir James Paterson Ross at the dinner given to the national representatives by the council of the Royal College of Surgeons, and those of Sir Lionel Whitby and Sir Russell Brain, president of the Royal College of Physicians, at the congress banquet, showed that physical medicine was welcomed by the leaders of medical thought and action as a young and dynamic partner. . . . The physical medicine specialist needs to be a 'good doctor' as well as a trained clinician. . . . This is the medicine of the future, but its disciples must remember and live the warning of their president: Le malade, toujours, le malade. [The patient, always, the patient.]"

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[1] Editorial: International Congress of Physical Medicine, Lancet 2:187 (July 26) 1952.

THE EFFECT OF ULTRASOUND ON THE TRANSMISSIBLE WALKER RAT CARCINOMA [*]

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The paper by Wood and Loomis[1] in 1927 which told of the harmful and sometimes lethal effects of high frequency sound on mice, small fish, frogs and unicellular organisms was followed by reports of various investigations on the biologic effects of ultrasonic waves.[†] It was amply demonstrated that necrosis of tissue may occur as the result of exposure to ultrasonic vibrations of sufficient frequency and intensity. This means of destroying tissue has been examined by a number of workers with respect to the effect on certain transmissible tumors of animals.

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[*] From the Division of Experimental Medicine, Mayo Foundation, University of Minnesota, Rochester, Minnesota.

[*] Abridgment of thesis submitted by Dr. Schroder to the Faculty of the Graduate School of the University of Minnesota in partial fulfillment of the requirements for the degree of Master of Science.

1. Wood, R. W., and Loomis, A. L.: The Physical and Biological Effects of High-frequency Sound Waves of Great Intensity, Philosophical Magazine, S. 7 4:417 (Sept.) 1927.
2. Herrick, J. F.: Some Biologic Aspects of Ultrasonics, Arch. Phys. Med. 30:115 (Mar.) 1949.
3. Nelson, P. A.; Herrick, J. F., and Krusen, F. H.: Ultrasonics in Medicine, Arch. Phys. Med. 31:6 (Jan.) 1950.
4. Lehmann, J.: Die Therapie mit Ultraschall und ihre Grundlagen. In: Ergebnisse der physikalisch-diatetischen Therapie. Band 4. Dresden u. Leipzig, 1951, pp. 196-272.
5. Der Ultraschall in der Medizin. Vol. 1, 1949; vol. 2, 1950; vol. 3, 1951; vol. 4, 1952. Zurich, S. Hirzel Verlag.

[†] For recent surveys of the literature on the biologic effects of ultrasound and its application in medicine, the reader is referred to review papers by Herrick,[2] Nelson, Herrick and Krusen,[3] Lehmann[4] and the various papers in *Der Ultraschall in der Medizin.*[5]

According to Gőzsi[6] ultrasonic energy has no effect on Ehrlich's carcinoma. Nakahara and Kobayashi[7] found that a single treatment of 1 minute's duration enhanced the growth of intracutaneous adenocarcinomas of mice but had no effect on the subcutaneous growths. Hayashi,[8] working with a rat sarcoma, reported that implants of tumor did not grow if they had been exposed to ultrasonic waves for more than 5 minutes before implantation. Later Hayashi[9] recorded that the rat tumor growing in situ was resorbed after exposure to ultrasonic energy. Namikawa,[10] using rabbit sarcomas, reported that tissue exposed for 3 minutes before implantation was resorbed, whereas a chicken sarcoma exposed "lightly" grew well; however, if this tumor was exposed for 10 minutes its growth was inhibited. Bennett[11] examined a transmissible lymphosarcoma of chickens after exposure to ultrasound and found destruction of cells only in the path of the ultrasonic waves. The rest of the tumor was not altered, and the treatment had no effect on longevity of the tumor-bearing chickens.

Woeber,[12] using doses of 1 to 2.1 watts per square centimeter at frequencies of 800 to 1,000 kilocycles, could find no beneficial effect on the Ehrlich carcinoma, on a transmissible chondroma of mice, or on the Walker rat carcinoma. However, he found that in some animals the Jensen rat sarcoma was absorbed after treatment. Dittmar[13] concluded from his experiments that the Jensen rat sarcoma could be destroyed by treatment with ultrasound, whereas the Walker rat carcinoma resisted intensive exposure. Dittmar expressed the belief that the increased temperature in the tissue played an important part in the destructive process. Hausser and associates[14] found that the Jensen rat sarcoma could be destroyed in about 60 per cent of animals that survived treatment. These workers reported that the lethal dose of ultrasonic energy for rats was not much greater than the therapeutic dose, which was at least 1,000 watt-seconds per square centimeter. In their experiments the deaths due to ultrasound varied from 15 to 62 per cent, depending on the exposure. Working with the Walker rat carcinoma Beck and Krantz[15] found that there was some inhibition of growth of tumors exposed to ultrasound as determined by weights and measurements in comparison to control tumors. Grütz[16] reported that ultrasonic waves had a specific destructive effect on the Walker rat carcinoma due to mechanical forces. Grütz stated that in some instances there was disappearance of the tumor for as long as 35 days after treatment.

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[6] Gőzsi, B. Quoted by Szent Györgyi, A: Chemical and Biological Effects of Ultra sonic Radiation, Nature 131:278, 1933

[7] Nakahara, Waro, and Kobayashi, Ryuji Biological Effect of Short Exposure to Supersonic Waves Local Effect on the Skin, Japan, J. Exper. Med 12:137, 1931

[8] Hayashi, S Über den Einfluss der Ultraschallwellen auf die Rattensarkomzellen Proceedings of the Japanese Physiological Society, Sixteenth Annual Meeting, Japan, J. M. Sc III Biophysics 5 136, 1938.

[9] Hayashi, S Einflüsse der Ultraschallwellen auf das Wachstum des Rattensarkoms Proceedings of the Japanese Physiological Society Seventeenth Annual Meeting, Japan, J M. Sc III Biophysics 5:162, 1938

[10] Namikawa, Y Einflüsse der Ultraschallwelle auf das Kaninchen und Hühnersarkom Proceedings of the Japanese Physiological Society, Sixteenth Annual Meeting, Japan, J M Sc. III Biophysics 5:137, 1938.

[11] Bennett, W. A Personal communication to the authors

[12] Woeber, Karlheinz: Untersuchungen über die Wirkung des Ultraschalls auf Mause und Rattentumoren, Strahlentherapie 79:563, 1949

[13] Dittmar, Carl Über die Wirkung von Ultraschallwellen auf tierische Tumoren, Strahlentherapie 78:217, 1948

[14] Hausser, Isolde, Doerr, Wilhelm; Frey, Rudolf, and Ueberle, Adolf Experimentelle Untersuchungen über die Ultraschallwirkung auf das Jensen Sarkom der Ratte, Ztschr f Krebsforsch 56:449, 1949.

[15] Beck, Frances F., and Krantz, J C, Jr Glycolysis in Tumor Tissue III The Effect of Ultrasonic Vibrations on the Growth and Glycolysis of Walker Sarcoma 319, Am J. Cancer 39:247 (June) 1940

[16] Grütz, O Histologische Untersuchungen an Tiertumoren nach Ultraschalleinwirkung, Strahlentherapie 79 577, 1949.

In view of the differences in results obtained by various workers it appeared desirable to study the effect of ultrasound on a transmissible tumor, the growth and histologic characteristics of which are well known. We report here our studies in which we could find no beneficial effect of ultrasound on the Walker rat carcinoma 256 with the maximal tolerated doses.

Methods and Materials

The Tumor. — The Walker rat carcinoma 256* was transmitted to male albino rats of the Wistar strain. The animals were approximately 3 months of age and weighed about 200 gm. each. For transmission whole tumors were removed from donor rats immediately after they had been killed by ether. Approximately 1 gm. of solid tumor tissue was cut from the periphery of the tumor, minced finely with scissors and mixed with 3 ml. of sterile physiologic saline solution. This was strained through several layers of gauze to form a suspension that would pass through an 18-gauge needle. This suspension was injected subcutaneously in 0.2 ml. amounts in the dorsal midline in animals used in the first experiment (table 1) but on the right side of the

TABLE 1. — *Summary of the Effect on the Walker Rat Carcinoma of Various Exposures to Ultrasonic Waves.*

Experiment Number	Animals*	Exposure		Remarks and Results
		Watts	Time, Min.	
1	6	15	5	No shielding. Tumor on dorsal midline. All animals had paralysis immediately after exposure. Slight superficial burning. One control and 1 treated animal killed in 1, 2, 3, 4, 24 and 36 days. No gross or microscopic evidence of any inhibitory effect on the tumor.
2†	5	15	5	One animal paralyzed. Superficial burning of skin. One control and 1 treated animal killed in 1, 3, 5, 7 and 9 days. Microscopically some necrosis of skin and subcutis. No gross or microscopic difference between treated and untreated tumors.
3†	5	15	8	One animal died immediately after exposure. Two died 6 and 17 days later, respectively. Two killed in 23 and 33 days, respectively. Burning of skin, subsequent loss of hair. Tumors of untreated animals killed when treated animals died were similar in size and microscopic appearance to those treated.
4†	11	15	10	Three died in 15 minutes, 3 in 3 hours and 1 in 8 days. Four killed in 21 days. Burning and hemorrhage of skin and subcutis. Hemorrhages on intestinal serous surface, and hemorrhage and desquamation of mucosa. Necrosis of abdominal muscle. Areas of necrosis of tumor cells similar to the spontaneous necrosis seen in controls.
5‡	5	50	4, 5, 6, 8 and 10 respectively	No deaths. Exposure for 4 minutes produced superficial burning. The longer exposures caused extensive burning and necrosis of skin with subsequent ulceration. Tumor cells adjacent to this were also necrotic. No evidence of inhibition of growth or regression of tumor due to ultrasound.
6‡	13	50	4	No deaths. Slight superficial burning which in 1 rat became ulcerated. No detectable inhibition of growth of the tumor. Coagulation necrosis of skin and of tumor cells immediately beneath skin. No other histologic evidence of destruction of tumor.
7‡	16	50	4§	No deaths. No apparent increase of superficial destruction compared to preceding group. No evidence of inhibition of tumor.

* An equal number of untreated control animals, a litter mate of each treated rat, was used in each experiment. The tumors were exposed when they were 10 to 14 days old and measured 1 to 2 cm. in diameter.

† Tumor on right side in experiments 2, 3 and 4. Attempt was made to direct the ultrasound through the tumor only.

‡ Tumor on right side in experiments 5, 6 and 7. Animals shielded; only tumor exposed.

§ Given twice, 4 hours apart, in 6 animals.

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* The tumor was obtained from Dr. John W. Green, Department of Pathology, University of Chicago, Chicago, Illinois.

animal about 1 to 2 cm. posterior to the last rib in animals used in the other experiments.

Palpable tumors were found within 5 days in about 90 per cent of recipients. In 10 to 14 days the tumors were 1 to 2 cm. in diameter. This was the age and size of tumors used for the study. As the tumors were permitted to grow they would expand to involve the entire right side of the animal in approximately 30 days. No metastatic growths were found in any animal. Superficial ulceration occurred on large pendant tumors. Areas of necrosis could be seen grossly in tumors as small as 1 cm. in diameter. Histologic examination revealed necrosis in practically all tumors regardless of size and age of the tumor. Gross and microscopic foci and confluent areas of necrosis were found in tumors of untreated animals as well as in those exposed to ultrasound (fig. 1). In no animal, however, was there any evidence of spontaneous regression and disappearance of a tumor.

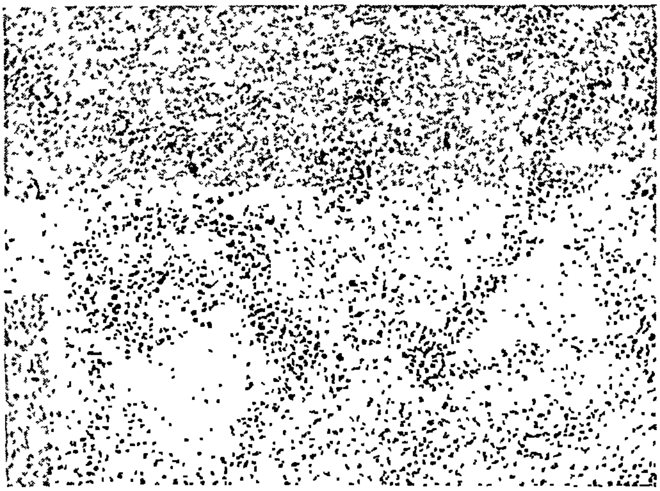

Fig. 1. — Spontaneous necrosis in Walker rat carcinoma. This change was regularly seen in all the untreated tumors as well as in those treated with ultrasound regardless of age and size of tumor (x115).

Source of Ultrasonic Waves. — The greatest part of the work was done using a Siemens sonostat (ultrasonic generator) (fig. 2), which generates sound vibrations at a frequency of 800,000 cycles per second with a maximal output of about 58 watts. The sound head as illustrated in figure 2 has a radiating surface of 10 square centimeters. A few experiments were done using a generator constructed by the Central Research Laboratories, Red Wing, Minnesota, which also generated sound vibrations at a frequency of 800,000 cycles per second with a maximal ultrasonic output of 13 to 14 watts and a sound head with a quartz crystal having a surface approximately 5 square centimeters in area.

Application of Ultrasonic Waves. — Preliminary trials in which no special attempt was made to shield the general body area indicated that protection of the spinal cord and viscera was needed. In some animals posterior paralysis and urinary incontinence developed when the vertebral column was in the path of radiation. In addition, petechiae were found on the serous surfaces of abdominal viscera of a few animals. The device shown in figure 3 was made to permit irradiation of a tumor on the right side of the animal without exposure of the body. This consists of a brass tube that fastens in vertical position to the sound head by means of a water-tight coupling. An opening in the side of the brass tube admits the tumor. The size of the opening can be varied by means of adaptors to accept tumors of different sizes.

As a contact medium, water which had been degassed by boiling and then cooled to room temperature was placed in the tube after the tumor had been inserted into the side opening. Degassed water was used to ensure the transmission of ultrasonic energy from the sound head to the tumor. A very thin layer of air will absorb all the ultrasonic energy. Aerosol was applied to the shaved skin over the tumor to minimize bubble formation at the water-skin junction and make a good coupling to the ultrasonic energy.

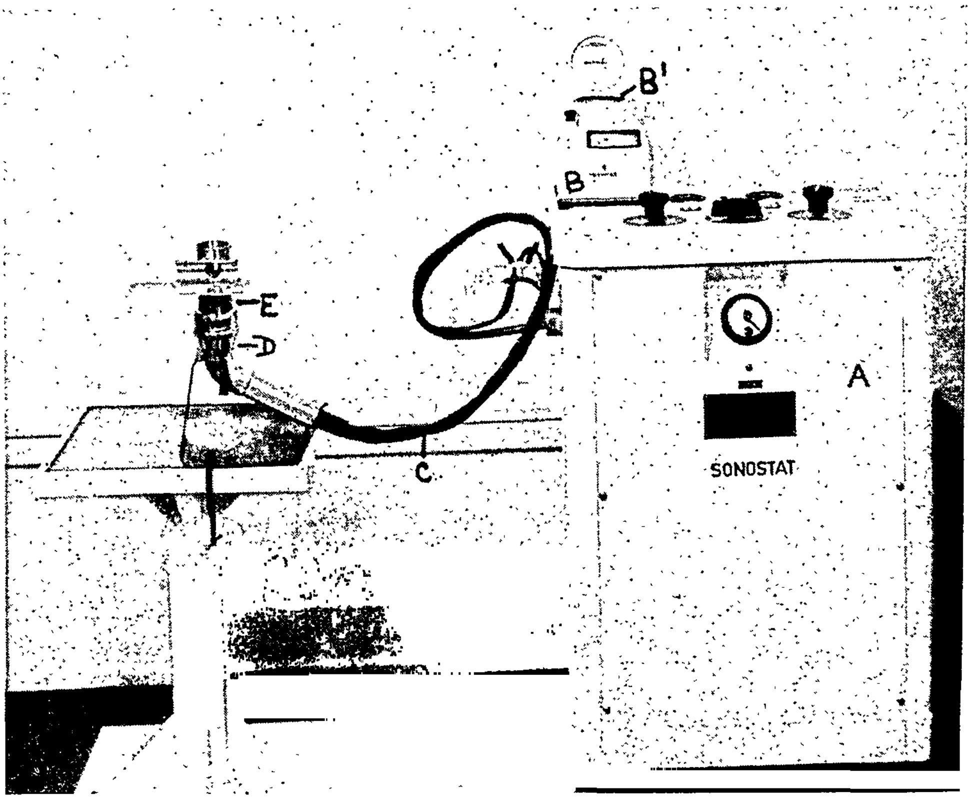

Fig. 2. — Apparatus used to expose tumor-bearing rats to ultrasound. A. Siemens sonostat. B. Siemens ultrasound power meter. B^1, Aperture for sound head when power measurements are made. C. Coaxial cable for transmitting high frequency oscillations to sound head. D. Sound head. E. Device for shielding rat while exposing tumor (see Fig. 3).

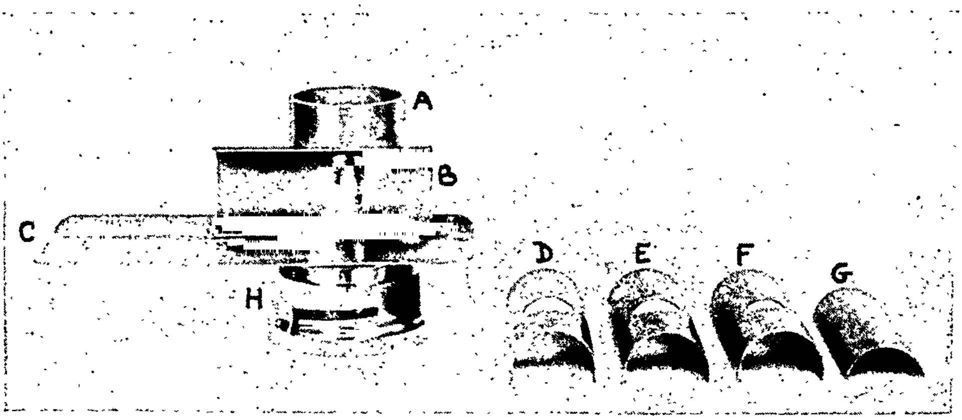

Fig. 3. — Device to shield the body of a rat while its tumor is exposed to ultrasound. A brass tube (A) is fitted with a water-tight coupling (H) which fastens in a vertical position to the sound head. The anesthetized rat is placed in a prone position on the platform (C) with the head to the left. The right side of the animal is fitted snugly into the curved shield B. The tumor, which is on the right abdominal wall, is placed into the opening so that it projects into tube A. Adaptors with varying size holes (D, E, F) are to accommodate tumors of different sizes to make a tight fit in order to prevent leakage of water. A support plate (G), which fits into spring clips at the bottom of B, is placed on the left side of the animal to hold the body snugly against the curved shield B. The tube, with the tumor projecting into it, is filled to the top with degassed water.

Anesthesia of the animal was maintained during exposure to ultrasound by ether added dropwise to cotton fitted into a wire mask placed over the animal's head.

For each exposure the output of the sound head was measured before and after each treatment by means of the Siemens ultrasound power meter (fig. 2B).

To measure any increase of temperature in the exposed tumor, thermistors[17] were inserted into the tissue. The temperatures were recorded 30 seconds after the ultrasonic generator had been shut off. In living animals temperature increases were recorded ranging from 2.5 degrees C. to 18.2 degrees C. with a mean of 10 degrees C. When tumors of dead animals were exposed there was an increase of temperature ranging from 6.4 degrees C. to 17.9 degrees C. This increase of temperature was taken as proof that energy was being transmitted to the target area.

In all experiments litter mates with tumors were used as untreated controls.

Results

The data showing the number of animals in each group, the exposure, and the results are presented in table 1. The first four experiments were more or less exploratory in nature, and were done without the protective device shown in figure 3. In the first group the tumor was growing on the dorsal midline. Exposure to 15 watts for 5 minutes without body shielding resulted in paralysis which persisted for at least 5 days. There was some hemorrhage of the skin over the tumor. One treated and 1 control animal were killed 1, 2, 3, 4, 24 and 36 days, respectively, after exposure. There was no gross or microscopic evidence that the treatment had altered the growth of the tumor.

In the second, third and fourth experiments the tumors were present on the right side of the animal and an attempt was made to direct the path of the ultrasonic energy upward through the tumor without including the body. The exposures in these three experiments were, respectively, 5 minutes, 8 minutes and 10 minutes of 15 watts each in order to determine the acceptable dose. As shown in table 1 there were animals with paralysis or early deaths in each group. These effects were presumably due to the exposure of the abdominal organs and the spinal cord. Animals that died within a day were found to have petechial hemorrhages on the serous surfaces of the abdominal viscera. Subsequent microscopic study revealed congestion of the parenchymal organs and in the portions of the wall of the intestinal tract that were adjacent to the path of the ultrasonic waves. The cause of death could not be determined.

In these first four experiments the number of animals was small and was further reduced by the early deaths of treated animals. However, on the basis of size, gross appearance of cut surfaces and histopathologic examination, there was no evidence that exposure to ultrasound in the doses given had any effect on the tumors.

The greatest dose used in the first four experiments, which was 15 watts for 10 minutes, produced the greatest amount of superficial burning and necrosis of the subcutaneous tissue. In these animals, as in a few of those in other groups, there was some coagulation necrosis of superficial layers of tumor cells immediately underlying the burned skin, as shown in figure 4. In other respects the treated tumors were the same as those of untreated animals. In animals that survived and were eventually killed the tumors were as large as those of the control animals and the latter had the same extent of necrosis and liquefaction of the tumor as did the treated animals.

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[17] Herrick, J. F., and Glarborg, E. A.: Application of Thermistors to Temperature Measurements in Experimental Investigations, Proc. Minn. Acad. Sc. 17:87, 1949.

When it was found that the animals could be protected against paralysis of the rear legs and petechial hemorrhage of the abdominal viscera by means of the device shown in figure 3, it was decided to increase the intensity of exposure applied to the tumors. In the subsequent experiments none of the animals showed evidence of general body exposure such as paralysis, urinary incontinence or death. In experiment 5 (table 1) the tumors of 5 animals were treated with 50 watts for periods of 4, 5, 6, 8 and 10 minutes, respectively.

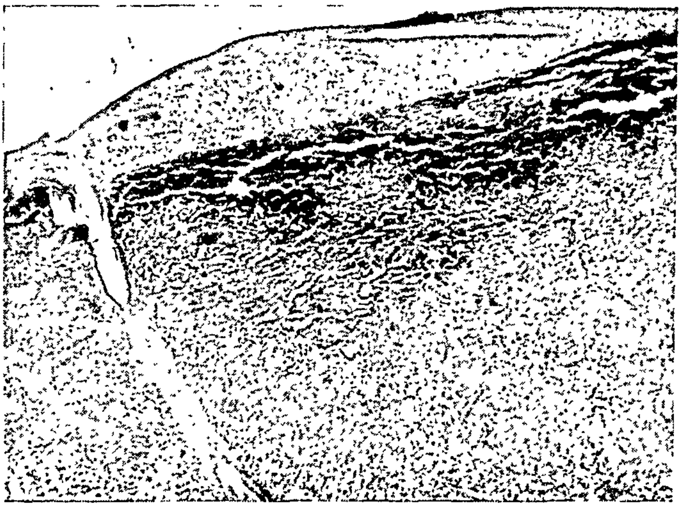

Fig. 4. — Necrosis of skin and underlying structures, including a hair follicle, two days after exposure to ultrasound of 50 watts for 4 minutes. There is also a shallow area of necrosis immediately below this portion of skin, but the remainder of the tumor appears to be unaltered (x60).

Exposures longer than 4 minutes at 50 watts produced burning of the skin with subsequent ulceration and sloughing which included the surface of the tumor. There appeared to be no regression of the tumor, however. The animal whose tumor was exposed to 50 watts for 5 minutes was killed in 8 days. In spite of the extensive superficial necrosis the tumor had expanded during this period and appeared to be growing normally as compared to the untreated tumor. Microscopically there was coagulation necrosis of the skin including destruction of the hair follicles and glands as shown in figure 4. Immediately below this area the tumor consisted of a necrotic homogeneous mass with nuclear debris. This area of destruction extended into the tumor for only several layers of cells. Aside from these superficial changes, the tumor appeared microscopically to be growing normally and to be undergoing the process of ischemic necrosis as seen in the untreated animals. These changes were seen in each of the other animals in this series but were more extensive in the animals exposed for longer periods than in those exposed for shorter periods.

In the sixth experiment the tumors of 13 rats, each with 13-day-old tumors about 2 cm. in diameter, were exposed to ultrasonic radiation of 50 watts for a period of 4 minutes. Each exposed tumor was found to have a dark discoloration of the skin on the side facing the source of the ultrasonic waves. One rat was killed on the third day after exposure because of the large area of ulceration and bleeding. The remaining animals were killed at periods from 8 to 27 days after exposure. During this period each tumor continued to increase in size in a manner comparable to that of tumors in the untreated animals. Microscopically, the tumors of the treated animals resembled those of the controls except for the destruction of the skin and necrosis of muscle and a few superficial layers of tumor cells.

The last experiment was similar to the preceding one except that in 6 of the animals the dose of ultrasonic energy of 50 watts for 4 minutes was repeated in 4 hours. This second treatment appeared to produce no greater effect with respect to burning and ulceration than was obtained by a single exposure. There was likewise no apparent inhibition of growth of the tumor as judged by gross inspection or by histologic examination.

Comment

The Walker rat carcinoma 256 developed at a uniform rate, and seldom was there any variation in the expected size of 1 to 2 cm. in diameter in 10 to 14 days. This provided the desired uniformity of material in the treated and untreated animals. It is of more than a little interest to note that no evidence of metastasis was found in any animal. It was therefore possible to expose a tumor which grew and remained at the site of inoculation without taking into consideration the possibility of distant metastatic growths that could not be reached by the ultrasonic waves. Furthermore, the absence of total spontaneous regression and disappearance of this tumor permits evaluation of therapy.

The constant presence of small foci and large confluent areas of ischemic necrosis or infarction in all untreated tumors as well as in those exposed to ultrasonic energy presented some difficulty in histologic evaluation of the effect of the treatment until one became thoroughly familiar with this natural retrogressive change. This characteristic of the Walker rat carcinoma detracted from its usefulness in this study.

There was no evidence of any selective destructive effect of the ultrasonic waves for the malignant cells, since any necrotic changes within exposed tumors could be attributed to the infarction that occurred also in the control rats. The only direct result of the exposure to ultrasound was the mild to severe burning of the skin over the exposed tumor, which, with intense energy, extended to underlying structures including muscle and a few layers of tumor cells. Even with doses that produced extensive destruction of the skin and a portion of the tumor, there was continued growth and expansion of the neoplasm from areas immediately adjacent to those which appeared to be injured. The number of mitotic figures in tumors exposed to ultrasonic waves was as great as in the untreated tumors.

Summary and Conclusions

The transmissible Walker rat carcinoma 256 was transplanted to series of rats. When the tumors attained a diameter of 1 to 2 cm. they were exposed to ultrasonic energy ranging in intensity from 15 watts for 2 minutes up to 50 watts for 10 minutes. There was no gross or microscopic evidence that the treatment had any specific inhibitory effect on the neoplasm.

Exposure of the spinal cord to ultrasonic waves produced paralysis and urinary incontinence. There were also petechial hemorrhages of the serosa and mucosa of intestinal layers that were in the path of the radiation. These complications were avoided by constructing a device which permitted exposure of the whole tumor while shielding the rat's body against the ultrasonic energy.

RELAXATION OF SPASTICITY BY ELECTRICAL STIMULATON OF ANTAGONIST MUSCLES *

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Pollock[1] defines spasticity as a condition which is "demonstrable by a sustained increase in tension over normal when the muscle is passively lengthened. The increase is felt from the beginning of the passive movement, and is in proportion to the extent to which the muscle is lengthened." On the basis of our observations we would disagree with part of this definition, since we have noticed that spasticity may be evident in a limited portion of the range and not necessarily to the extent to which the muscle is lengthened. We would rather describe spasticity as a condition of paralysis or muscular weakness associated with hyperreflexia, the symptoms of which include increased resistance to manipulation, exaggeration of the deep reflexes, and clonus.

At rest the spastic muscle may show no sign of spasticity, but the condition of rest is not always obtainable. "Both passive and active movement, as far as the latter is possible, produce a marked response in the muscle subjected to stretch by the examiner or by the patient himself" (Hoefer).[2] Spasticity over a period of time leads to shortening of the affected muscle's range of motion, and eventually to contracture. Our own experience has been that spasticity in some individuals interferes with the complete utilization of potential motor power during the rehabilitation of patients with paralysis. The exact nature of spasticity has not been elucidated. Some understanding of it, has resulted from the work of Magoun and his collaborators.[3] They compare spasticity to decerebrate rigidity as described in animals by Sherrington.[4] We concur with this as being descriptive of some types of spasticity and assume, as a result, that in these types, the spasticity is associated with the removal of affected muscle action from numerous suppressor areas in the brain. Magoun and his co-workers have also reported that the removal of inhibitory stimuli in spasticity is only part of the story and that there is every likelihood that facilitation of the involved reflexes actually occurs.

A number of therapeutic procedures are in use at the present time in the treatment of spasticity. Foerster[5] employed section of most of the posterior spinal roots conveying proprioceptive impulses from the affected extremity. This procedure, as pointed out by Magoun, attacks the exaggerated stretch reflexes in the afferent limb of the reflex arc. A second neurosurgical approach has sought to reduce the imbalance of central inhibitory and facilita-

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* From the Kabat-Kaiser Institute, Vallejo, California.

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[2] Hoefer, P. F. A.: Diseases of the Basal Ganglia, Chapt. XII, Physiology of Motor Innervation in the Dyskinesias, Baltimore, 1942.

[3] Magoun, H. W., and Rhines, R.: Spasticity: The Stretch Reflex and Extrapyramidal System, Charles C Thomas, Springfield, 1947.

[4] Selected Writings of Sir Charles Sherrington, edited by Denny-Brown, D., Paul B. Hoeber, Inc., New York, 1940.

[5] Foerster, O., und Altenburger, H.: Zur Physiologie und Pathophysiologie der Sehnen-und Knochenphanomene und der Dehnungsreflexe. I. Mitteilung: Zur elektrophysiologischen Analyse der Sehnen- und Knochen-Phanomene bei Gesunden., Ztschr. f. d. ges. Neurol. u. Psychiat. 146:641, 1933.

tory influences operating on the reflex arc by cutting down the number of facilitatory connections reaching the spinal gray matter. As Magoun states, "Its efforts have so far met with only transient or partial success for the apparent reason that facilitatory influences are conducted in the cord by three separate pathways whose inclusive distribution encompasses all the spinal white matter outside the posterior columns. Interruption of the cortico-spinal (Putnam[6]), or vestibulo-spinal (Bucy[7]) tracts alone has not prevented spasticity. Partial interruption of facilitatory reticulo-spinal connections (Hyndman[8]), has caused some lasting reduction in spastic symptoms, but these descending connections from the reticular formation unfortunately appear to be distributed so diffusely in the cord that their complete interruption might, in relieving spasticity, unavoidably sever so many other paths as to leave the patient in a more incapacitated state than before."

We have reported that relaxation of muscle spasticity can be brought about with the aid of therapeutic techniques of active exercise,[9] and through the use of pharmacologic agents.[10] Heat, passive stretching and other stock procedures have been used with a degree of success. Electrical stimulation has been employed for almost 100 years by various workers in the treatment of this condition. Most commonly the stimulation is of the spastic muscle, and beneficial results have been attributed to fatigue. It is interesting, however, to note that as far back as 1871 Duchenne[11] employed stimulation of the antagonists to relieve spasticity, although at that time he could not have been aware of the rationale of such an approach.

For some time we have been studying the dynamics of voluntary movement in man. During the course of this investigation, we have had the opportunity to reassess the importance of reciprocal innervation in voluntary movement. The details of this study are published elsewhere.[12] We may summarize our results by stating that in normal voluntary human movement there is at present insufficient evidence that reciprocal innervation plays the role in the co-ordination of the contraction of antagonistic muscles, which is assumed for it by most current thinking on kinesiology. Co-contraction seems to be the rule rather than the exception. It is quite possible that reciprocal innervation is important in volitional movement, but the mechanical translation of Sherrington's phenomenon to voluntary movement is not justified.

Most of Sherrington's experiments were performed on muscles in either spinal, decerebrate, or anesthetized animals. Under such conditions, he was actually studying reciprocal innervation in the reflex state. He made some attempt to study the phenomenon in volitional movements of the eye muscles of the monkey, but the results were actually inconclusive. During the course of our studies, we assumed that reciprocal innervation should be demonstrable in the human in certain reflex states such as spasticity. Sherrington has reported that in the decerebrate animal, relaxation of the antagonist could be observed following faradic stimulation of the motor nerve of the agonist. With this in mind we applied this form of electrical stimulation to the muscles antagonistic to those showing spasticity in patients with neuromuscular disease. We were able to observe the same relaxation which Sherrington had observed in his experiments on reciprocal innervation.

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[12] Levine, M. G., and Kabat, H.: Co-contraction and Reciprocal Innervation in Voluntary Movement in Man, in press.

Method

A fairly large (at least 3 by 4 inches) moist pad dispersing electrode is placed on a portion of the body at a distance from the part to be stimulated. An active small moist pad electrode (1 inch in diameter) is placed in good contact with the skin over the middle of the muscle belly on the motor point, or on a point which gives a maximum contraction. Faradic stimulation with a frequency of about 100 per second is employed to give a tetanic contraction. The intensity of the current should be sufficient to give a maximum contraction. The active electrode is kept on the motor point until the antagonist relaxes. Relaxation may not begin until a number of seconds have elapsed, and then appears to be cyclic, so that if the tetanizing current is maintained for a period of time, progressive relaxation appears to be spaced at intervals. The cause for this is under study at the present time. When the electrode is applied, the part is carried passively and slowly through the desired range of motion. Relaxation should precede forceful movement through the range, whether by voluntary effort of the patient or through passive movement by the therapist. The persistence of the effect, which is apparent in the patient treated, depends on taking advantage of the relaxation to carry the part through its full range of motion. Maximum relaxation and its persistence depend on completing as much as possible of the range during relaxation. As an illustration of the procedure, the following example may be helpful: If spasticity of the triceps prevents full flexion of the elbow, the active electrode is placed over the motor point of the biceps with current of sufficient intensity so that a full contraction of the biceps is observed. If the patient has voluntary control, he is told to assist the therapist in carrying the limb through its maximal range of flexion. It is important that the voluntary or passive flexion accompany the relaxation rather than precede it, since force applied against the spastic extensor before relaxation occurs merely increases the spasticity. The electrode is kept on the biceps for as long as one minute or more depending on whether complete relaxation has occurred. It is possible to judge relaxation in two ways: If the spasticity is constant, it impedes movement. Constant pressure on the forearm during passive flexion should cause the therapist to feel the arm "give" when relaxation occurs; another method, in the same example, is to feel the decrease in spasticity during rapid passive flexion. Normally, without relaxation, during rapid passive flexion, the movement will be impeded at one or more points because of the spasticity of the extensors. If the same movement is made with the electrode on the biceps, the impedance is reduced or eliminated.

It is also important in obtaining the full range of motion to carry the part through its normal pattern of movement. In the case of flexion of the elbow, for example, maximum range is best obtained when the forearm is supinated during elbow flexion while the shoulder is flexed and adducted. Such patterns of movement have been described in previous reports.[8]

Results

We have tried this form of relaxation in a large number of patients with spasticity and with a variety of neuromuscular diseases. The immediate response of relaxation of spasticity is very evident. The persistence of the relaxation effect appears to depend on the amount of relaxation which occurs at the time of stimulation and on the individual patient. Spasticity may not be confined to one muscle so that it is important to diagnose the exact muscles involved and to determine empirically the antagonist to be stimulated. A number of representative case reports will illustrate the response.

Patient A. W., age 25, male, diagnosis — left hemiplegia following an auto accident on October 16, 1948. Initially there was complete paralysis of the left upper and a good deal of weakness in the left lower extremity. When he was seen in July, 1949, marked spasticity was present in the upper extremity, less in the lower. The upper extremity was completely paralyzed except for slight motion in the shoulder. The leg showed considerable weakness. Over a period of four months, treatment resulted in improvement in function of the lower extremity and restored to a degree the gross motions of the shoulder and elbow. The wrist and fingers, however, were still severely paralyzed, with only a trace of voluntary extension. A slight decrease in the spasticity of the wrist and fingers was evident. Short periods of therapy followed at scattered intervals, and by December, 1951, the patient's main problem was the spasticity of the wrist and fingers. With attempted extension of the wrist, the fingers went into automatic flexion and over a period of time became fixed in flexion. At this time, the problem of finger nails digging into the palm of the hand was of great practical importance. Spasticity of the shoulders and elbows was still present.

To relieve the spasticity of the flexors of the wrist and fingers, the radial nerve was stimulated above the elbow as were the long extensors and interossei of the fingers. At the elbow, the spastic flexors were relaxed by stimulation of all three heads of the triceps. Shoulder spasticity in the posterior deltoid and latissimus muscles was relaxed by stimulation of the pectoralis major and the anterior deltoid. Relaxation of the fingers followed immediately and lasted over a period of time if the patient passively extended them. While the patient was under observation for a period of three months, his spasticity never returned to what it was before electrical stimulation, however, there was a gradual return from the complete relaxation immediately following the stimulation. Since this patient had no voluntary control in the fingers, it became necessary to seek some method for maintaining the relaxation. Repeated electrical stimulation would serve this purpose; but since this was impossible in practice, it was found that the patient could maintain his relaxation over an extended period of time by submerging the hand and wrist in hot water (about 100 degrees F.) for fifteen minutes whenever indicated. No other form of therapy was used on the patient so that we were able to study the effect of electrical stimulation in a fairly well-controlled situation.

Patient F. T., age 39, male, in 1948 had a right hemiplegia as a result of a cerebral accident. Six months later gangrene of the right leg necessitated amputation. The patient was first seen in October, 1949, at which time a tentative diagnosis of thromboangiitis obliterans was made, a diagnosis which was confirmed pathologically when gangrene required the amputation of the other leg in 1951.

When first seen, the patient's right upper extremity showed paralysis with marked spasticity but with residual voluntary control in all motions. There was marked limitation of range of movement in the shoulder and elbow. There was spasticity in the pectoral, posterior deltoid and latissimus muscles, with more spasticity in the pectoral than in the others. At the elbow, spasticity was present in the triceps and biceps but more marked in the biceps. There was considerable weakness in flexion and extension of the fingers and wrist with marked spasticity in the wrist and fingers in both flexion and extension, with more in flexion. The wrist was held in the neutral position but the fingers and the thumb were partially flexed.

Over a period of time physical therapy increased the range of motion as well as the power at the shoulder and elbow, and to a lesser extent at the wrist and fingers. Electrical stimulation was begun on December 10, 1951, on the following muscles: the anterior deltoid, the pectoralis major, the posterior deltoid and the latissimus muscles, with emphasis on the posterior deltoid and the latissimus. At the elbow, the triceps and biceps were stimulated with more emphasis on the triceps. At the wrist, the extensors and flexors were stimulated with emphasis on the extensors. The patient attained considerable relaxation at the end of three days of stimulation. The shoulder improved so that the patient was able to improve abduction from 40 per cent previous to stimulation to 75 per cent of the normal range after stimulation. The elbow which formerly could be extended to about 60 per cent of complete extension, after stimulation gave the normal range of extension. Flexion at the elbow increased from 75 per cent before stimulation to 95 per cent of normal after stimulation. The fingers and the wrist could be completely extended after stimulation, whereas previously latent voluntary power was masked by the spasticity. Complete flexion was possible in the wrist and fingers without the effort necessary previous to stimulation. Pain at all joints associated with the spasticity was relieved. There was a slight residual of spasticity in the index finger and the thumb, which was relaxed after further stimulation.

The patient received a constant amount of resistive exercise before and after the electrical stimulation so that it was possible to control the effect of the stimulation. No other methods of relaxation were employed in this or any of the other patients mentioned in this paper.

Patient C. K., a 23 year old male miner, diagnosis incomplete paraplegia, was crushed from above by a rock fall in March, 1951. When the patient was seen in July, 1951, a diagnosis was made of compression fracture of T-9 and L-2 with severe comminution of the latter. The basic sensory level was found to be L-2 on the left and L-5 on the right. His upper extremity and neck showed generalized weakness and a slight disuse tremor. Muscles of the trunk were fair. His upper reflexes were slightly depressed, the lower absent, and the cremasteric sluggish. The lower abdominal reflexes were hyperactive. The hip flexors and the quadriceps on the left side showed a flicker of activity. On the right there was a fair contraction of the sartorius, hip flexors, adductors and quadriceps. By February, 1952, after intensive treatment, the patient was able to do a four-point gait pattern with long leg braces and crutches for a distance of at least 500 feet and had learned to get in and out of his wheel chair. He had obtained a fair degree of bladder control, being able to hold his urine for up to six hours.

In this patient marked spasticity of the hip and knee extensors as well as in the hamstrings made self-care difficult. He was unable to dress himself or to move freely. As a matter of fact, spasticity of the hamstrings made it difficult to obtain the full potential of muscle power which existed in the extensors of the knee. Pain was a problem whenever the hamstrings were stretched either through voluntary or passive movement. Pain also interfered with passive or voluntary stretching of the hip extensors. Electrical stimulation of the quadriceps and iliopsoas made it possible to stretch the hamstrings without pain, so that the patient was able to achieve adequate range of knee extension permitting more complete rehabilitation. In addition to improvement in power and range of muscle activity, the patient was better able to dress himself and to utilize his wheel chair as a result of the relaxation of the spasticity. No other methods for relaxation of spasticity were employed in this patient at the time of the experiments on electrical stimulation.

Although in the partial paraplegic spasticity may not always mask potential motor power, the importance of relaxing spasticity so that the full range of passive motion of a joint can be attained must be emphasized in these cases. Contracture becomes a real problem in these individuals even without appreciable voluntary control.

Patient S. S., 46 year old male, diagnosis multiple sclerosis, developed muscle weakness in 1939 which progressed until he had a spastic quadriplegia, with marked spasticity of both lower and upper extremities as well as of the trunk. An intensive daily physical therapy program supplemented with gymnasium and gait training, as well as occupational therapy resulted in considerable improvement, so that by March, 1950, he was able to stand on crutches independently and walk with a little assistance. There was improvement in his arms, hands, and trunk both in range of movement and in power. There was little or no improvement in the lower extremity because of severe spasticity evidenced in all directions of motion. The patient could not sit in a chair properly because he was unable to flex his hip or his knees adequately, and a pillow had to be used to separate the knees as a result of adductor spasticity.

Electrical stimulation of the psoas and tensor resulted in improvement of hip flexion and relaxation of the spasticity in the adductors while stimulation of the hamstrings relaxed the spasticity at the knees and permitted unimpeded flexion of the joint. The resulting improvement in the sitting posture enabled the patient to function more adequately in the various activities constituting self-care. No other type of relaxation procedure was used in this patient at the time of the experiments on electrical stimulation.

This last patient illustrates an interesting phenomenon which is apparent in such cases. After treatment, long leg braces were necessary to accomplish standing, whereas previously he was able to stand erect because of the spasticity in the hips and knees. Where voluntary control of the extensors of the knee and hip is not adequate to attain an erect posture, spasticity may result in sufficient contraction of these muscles so that the patient is able to stand. In such a case the spasticity is actually of value to the patient. Frequently, a decision must be made whether the relaxation will prove beneficial or will interfere with certain practical functions such as standing. In this last patient the sitting position was more important for rehabilitation than was unaided standing, so that we felt the attainment of a proper sitting position necessitated the relaxation in spite of the fact that long leg braces would have to be supplied to permit proper standing.

We have stated above that spasticity may mask potential voluntary movements. There are other times, however, when spasticity facilitates contraction. We have observed this, and Twitchell[13] has remarked on it in his studies on the restoration of motor function following hemiplegia in man: "It has often been assumed that if spasticity could be abolished, willed movement could be more effectively performed. Though this might be possible in certain spinal disorders, the present studies indicate that the first movements to appear following hemiplegia are themselves facilitated stretch reflexes. The problem at that stage is not so much to abolish the spastic reaction as to harness its diffuse hyperactivity."

Spasticity becomes a problem which must be considered individually in each case. At times its facilitating effects must be emphasized, whereas at other times quite obviously its elimination increases voluntary control. Added to these factors is the problem of contracture and range of motion, all of which must be considered in prescribing in relation to spasticity.

Summary

A number of procedures are at present employed in the treatment of spasticity. None of these is completely adequate, so that there is a need for further exploration of therapeutic approaches to the problem. In this regard, we have developed a procedure involving faradic stimulation of muscles antagonistic to those showing spasticity. The resulting relaxation, we feel to be due to reciprocal innervation.

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[13] Twitchell, T. E.: The Restoration of Motor Function Following Hemiplegia in Man, Brain 74:443, 1951.

ELECTRICAL STIMULATION IN THE TREATMENT OF INTRACTABLE STRESS INCONTINENCE *

A Preliminary Report

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In recent years increasing interest has developed in the non-operative management of stress incontinence. Physical exercise of the perineal muscle and connective tissue structures which play major roles in the voluntary inhibition of urination has been particularly emphasized. A small group of patients, however, because of anatomic, pathologic or psychic factors. are unable to exercise because they can not contract those anatomic structures involved in the voluntary inhibition of urination. This is a preliminary report of the results obtained in the study of such a group of women. Treatment consisted of electrical stimulation of perivaginal musculofascial structures involved in the voluntary inhibition of micturition. Volitional exercise therapy was used in conjunction with the electrical stimulation.

The actual mechanism of stress incontinence is not well understood and will remain a matter for conjecture until more is known about the anatomical and physiological factors which control inhibition of micturition. The involuntary escape of urine from the bladder as the result of effort accompanying sneezing, coughing or straining is usually explained as being due to injury of the voluntary urethral sphincters.

A special clinic for stress incontinence patients has been conducted by the Department of Obstetrics and Gynecology in conjunction with the Department of Urology at Northwestern University Medical School. A number of patients were seen in the clinic who had no ability to contract the structures used in inhibition of urination. Among them was a group who had no discoverable neurological or urological cause for their incontinence. Several of them had been unsuccessfully operated upon a number of times. The absence of perineal muscle contractility in these patients seems closely related to the inability of any voluntary muscle to contract when partially or completely denervated. It was thought, therefore, that by means of electrical stimulation it might be possible to develop the necessary muscular structures, and, in addition, initiate volitional effort.

Seventeen patients were selected to test this hypothesis. They were divided into two groups.

Group 1. — It was arbitrarily decided that the eight patients in this group would be given treatments twice weekly for a period of at least ten weeks unless their progress was such that further treatment would be deemed unnecessary. A modulated sinusoidal

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† Dr. Osborne died October 24, 1952.

current with a carrier frequency of 3 to 25 cycles per second was used.[1] Electrical stimulation was given for a period of five minutes at a rate of 12 to 24 contractions per minute. The active or stimulating electrode consisted of a metal cylinder which, with the exception of the section in contact with the tissues to be stimulated, was insulated with a rubber finger cot. This electrode was placed within the introitus, in contact with the vaginal mucosa, at the level of the musculofascial bundle which is contracted during voluntary perineal exercise. Surgical lubricating jelly was applied solely to the uninsulated section of the electrode which came in contact with the tissues to be stimulated. The dispersive electrode was placed beneath the dorso-sacral region. The current intensity was gradually increased until contraction and relaxation of the involved structures could be seen. When possible the current intensity was increased to the patient's maximum tolerance. All of the patients did not respond maximally to the same carrier frequency. When there was an excessive deviation from the optimal frequency there were vigorous contractions of the contiguous pelvic and thigh muscles. As soon as the patients were able to sense the rhythm of the stimulation, instructions were given to synchronize volitional effort with the contractions produced by the electrical current. When electrical stimulation was terminated the patients were requested to exercise without the aid of the current. As soon as they were able satisfactorily to perform volitional exercise, electrical stimulation was no longer used.

After ten treatments, four of the eight patients were able to exercise voluntarily. Electrical stimulation was discontinued and they were placed on the usual exercise regime. At the end of three months all of the patients in this group were reexamined. Three of them were free of incontinence. Two patients were greatly improved; although they had slight incontinence with severe stress, it was no longer a problem. Three of the group apparently were not benefitted.

Group 2. — The nine patients in this group were given daily treatments five days a week for three months unless their progress was such that further treatment was deemed unnecessary. The technique of treatment was identical with that of Group 1 except for an additional period of stimulation administered externally to the perineum. That phase of the problem is still under investigation.

The women in this group presented a variety of clinical problems. They had one complaint in common, which was stress incontinence. Also, they all had an inability to perform perineal exercises. Several of them had been given a trial with an intravaginal balloon without success. Most of them had had one or more unsuccessful surgical attempts to relieve incontinence.

The following case histories will illustrate the diversity of problems which were presented by this group of women.

Patient 1. — Mrs. M., 54, gravida XVI, para XV, was admitted with persistent dribbling to gushing incontinence aggravated by modest effort. Examination revealed a moderate cystourethrocele and rectocele. Two previous surgical attempts at relief, both vaginal, were unsuccessful. She had no contractile ability. Attempts at exercise with and without an intravaginal balloon were unsuccessful. Electrotherapy as described was instituted daily, five days a week. The patient noted improvement after three weeks. Muscular contractions were evident at that time. After 12 weeks incontinence was present only on severe stress. She was exercising effectively. By voluntary contraction the intravaginal pressure could be raised to 40 mm. Hg.

Patient 2. — Mrs. S., 42, para III, gravida III, was admitted with a history of constant dribbling incontinence of two years duration. She had had multiple operations for repair of a surgical vesico-urethral vaginal fistula. Although the fistula was closed the urethro-vaginal septum was composed chiefly of scar tissue. She had little contractile ability (intravaginal pressure with effort, 2 mm. Hg.) despite many months of exercise with and without an intravaginal balloon. Electrotherapy was instituted. After twelve weeks of five treatments weekly, incontinence was markedly improved. There was a definite increase in the thickness and tone of the urethro-vaginal tissues. Intravaginal pressure with effort could only be raised to 5 mm. Hg. Although slight incontinence was still present, with moderate effort she was no longer incapacitated by constant dribbling.

Three months after treatment all nine patients were examined to ascertain the result of the therapy. It was found that four were free of stress

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Personal Communication.—1. Since this work began we have learned that similar studies were being made by H. A. Burt, and J. Cooksey of King's College Hospital, London. [2] Bathurst and [3] Clayton outline similar methods of treatment. They, however, use and advocate a surging faradic current for the electrical stimulation rather than a sinusoidal current of low variable frequency.

2. Bathurst, L. W.: Incontinence of Urine in Women Treated by Electrotherapy, The Med. Standard 52:17, 1929.

3. Clayton, E. B.: Electrotherapy and Activotherapy, The Williams and Wilkins Co., Baltimore, 1949.

incontinence, two were markedly improved, and three were unimproved.

Summary and Conclusions

A preliminary report is presented of the results obtained in the treatment of intractable stress incontinence by electrical stimulation of the perivaginal musculofascial structures involved in voluntary inhibition of urination. The electrical stimulus, applied intravaginally, was a modulated sinusoidal current of variable carrier frequency. The first group of eight patients, treated twice weekly for five weeks or until volitional muscle contractions could be obtained, had the following results: Three were cured of their incontinence; two were improved; three were not benefitted. A second group of patients were given intensive treatments, five days a week for three months, or until volitional muscle contractions could be obtained. Four of the nine were cured of their incontinence; two were improved; three were unimproved.

It appears from the preliminary investigation that electrical stimulation of the perivaginal musculofascial structures involved in the voluntary inhibition of urination offers a possible means of relieving intractable stress incontinence in selected cases.

BIOPHYSICAL BASIS FOR THE SELECTION OF FUNCTIONAL BACK BRACES *

ODON F. VON WERSSOWETZ, M.D.†

Great confusion still exists regarding the etiology of chronic back pain; and, despite the extensive investigation of anatomy, physiology, and pathology of the spine, it is impossible to determine with certainty how and from where the pain originates. The scope of this paper will be limited to back conditions without permanent gross structural deformities. The possible causes of these conditions are too numerous for appraisal in so limited a time. So are the various methods of therapy, but it is generally accepted that, except in rare cases, all, at first, should receive conservative treatment. This consists of rest, medication, application of heat, massage, exercise and braces.

The main disability in back conditions is pain, occurring in certain definite regions of the spinal column, and localized there by the factors of mechanical strain resulting from the upright position of man. These areas of greatest stress are found where there is a change of direction of mechanical forces, namely, at the junctions and the apices of the curves. If the normal limits of stress and strain are exceeded, pathological manifestation occurs. The result is pain, which is localized in these areas of greatest stress.

In analyzing the disability of the back, emphasis should be placed on the function of the spine as a whole, or at least on its regions as units, considering the individual segments only so far as they influence this function. The amount of movement possible between any two adjacent vertebrae is very small; but, by the summation of these movements aided by the compressibility of the intervertebral discs, the vertebral column, as a whole, acquires a moderately extensive range.

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Because of the conjoined action and elasticity of its structures, the spine, in a healthy state, follows Hooke's law, which postulates that most bodies can yield a little and recover their original condition perfectly when the deforming force is removed. Within this limit, the body is said to be elastic and the effect produced is proportional to the cause producing it. If, however, the original cause of deflection should have been some morbid condition by which the elasticity of the column at a given point has been damaged or interfered with, then pathologic change may occur. This change may be small and may involve any of the structures composing or supporting the spinal column; and, because of the influence of gravity, it results in a certain amount of disalignment with consequent shift in the center of gravity.

When the spine has become abnormally deflected, however slightly, the weight of the superincumbent load of the head and the shoulders tends to maintain and exaggerate this malalignment. This is associated with an alteration of the normal position of the pelvis relative to the spinal column when the body is in the erect position. Muscle imbalance, whether as a cause or as a result, is another important factor in the production or maintenance of malalignment.

Basically, the object of a functional back brace is not to support the body load but to maintain, as normal as possible, the postural alignment. This should result in restoring weight-bearing stability of the spine, and relatively normal transmission of the forces of gravity and weight. The brace should correct malalignment and should preserve the maximal optimal function. Selection of a brace should be based upon a careful analysis of the disability and an accurate calculation of the kind, direction and amount of force required. The brace should prevent, if present, any abnormal mobility between vertebral segments, and should relieve the pressure or tension on the affected parts of the back. It should correct the excessive and imbalanced action of particular groups of muscles, which tend to fix or maintain the malalignment. It should also correct the position of the pelvis with reference to the spine and, further, prevent aggravation of the disability by direct exercise of mechanical force.

To be of any value, all spinal braces should be constructed on the "three-point" pressure system.[1] Two forces are used for stabilization and the third, applied between and counteracting these, is the kinetic force. The stabilizing forces should exert their pressure on the extremities of the spinal segment to be braced. Unfortunately, owing to the mobility of the interposed soft tissues, the mechanical forces cannot act directly upon the spine. Because of this interference, a considerable amount of the corrective forces is lost.

The kinetic force should be applied just below the apex of the curve. This tends to counteract gravity much more effectively, requiring less mechanical force than if the kinetic force were applied above the apex of the curve. Force applied in such a position tends to exaggerate the disability. Another important factor is to apply this active force as perpendicularly to the spinal curve as conditions will permit.

Braces for Prevention of Excessive Anterior Curves of the Spine

The primary region where an excessive anterior curve of the spine can occur is the lumbar area. Functional anterior curves of the dorsal spine are almost non-existent. An anterior lumbar curve produced by an excessive extension or hyperextension of the lumbar spine is usually associated with a protruding abdomen and with a downward and forward tilting of the pelvis. Extension of the lumbar spine normally causes narrowing of the intervertebral foramina, which may cause compression of structures within it. The spinal canal becomes shorter. The meninges, cauda equina and nerve roots become relaxed. The nucleus pulposus is displaced anteriorly. During this movement the weight is transmitted through the articular and spinous processes. In extreme hyperextension, some backward sliding of one vertebra on the one below may occur.

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[1] Jordan, Henry H.: Orthopedic Appliances, New York, N. Y., Oxford University Press, 1939.

The superincumbent weight of the body, in addition to other factors, tends greatly to increase the lordosis once it has been established. The essential feature of treatment is the restoration of normal alignment of the spine by correcting this excessive anterior curve. Theoretically, this can be accomplished by applying the kinetic force of the brace anteriorly and the two stabilizing forces posteriorly. This basic principle was suggested by Bigg.[2] The only objection to his brace is the use of axillary crutches, which tend to exert pressure in an unphysiologic manner.

The brace that has the best biophysical basis for correction of the excessive anterior lumbar curve is the Williams brace.[3] It is so designed that it permits free anterior flexion, but prevents extension and lateral bending of the lower lumbar spine (Fig. 1). The stabilizing forces are applied over the sacral spine and the thoracic spine just above the dorso-lumbar junction. The kinetic force is applied through a lower abdominal pad, attached to an abdominal support. The upper transverse bar has lateral uprights attached at each end. These lateral uprights are hinged at about the junction of the upper one-eighth of their length with diagonal bars of the pelvic band. The lower ends of the lateral uprights are free. Attached to them are pull straps, which run back to the ends of a short pelvic band, where their direction is reversed forward by metal rings, and finally they are fastened in front to the abdominal pad. Tightening these straps pulls the distal ends of the side bars

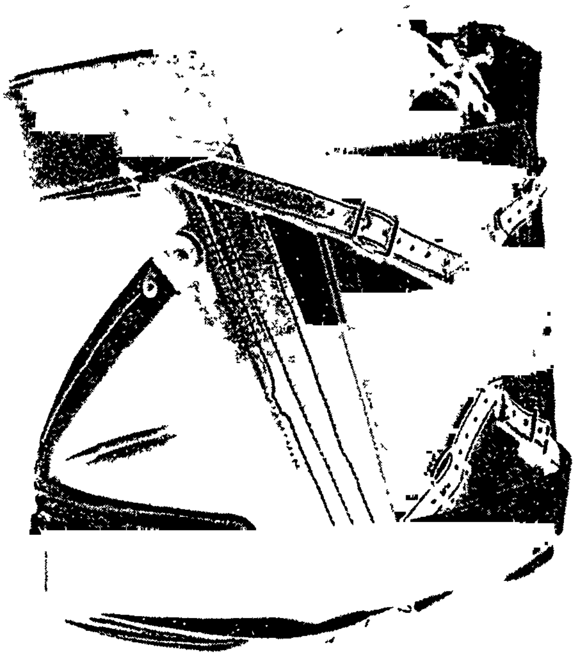

Fig. 1. — Williams' Brace.

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[2] Bigg, Henry Heather: Orthopraxy, London, J. & A. Churchill, 1877.
[3] Williams, Paul C.: Lesions of the Lumbo-Sacral Spine, J. Bone & Joint Surg. 19:690, 1937.

backward. This force is transmitted to the upper ends of the lateral uprights, and it is reversed in its direction at the hinge. This results in the upper transverse bar being actively forced forward. As a general rule, this brace is quite comfortable to wear though it needs frequent adjustments.

In mild cases of disability, the so-called sacroiliac braces, as developed by Goldthwaite[4] and Meyerding,[5] are useful. These stabilize the lower lumbar spine and apply a kinetic force through an abdominal apron or pad. The most commonly used brace is a modified Goldthwaite brace (Fig. 2). If properly constructed, it is an efficient device. It is made of two rigid metal back uprights, which extend from about an inch below the lower angle of the scapulae to the sacrum. These uprights are placed on either side of the midline of the back and about 3½ inches apart. Three short transverse metal pieces connect them for stability. Straps are riveted to each end of the transverse piece and are attached to an abdominal pad about 6 inches across and 4½ inches long, placed just above the symphysis. The back metal uprights should not conform to the lordotic position of the spine but should be practically straight and bridge this area. By applying pressure on the abdominal pad, the kinetic force is directed backward and upward toward the upright bars, resulting in a straightening of the spine.

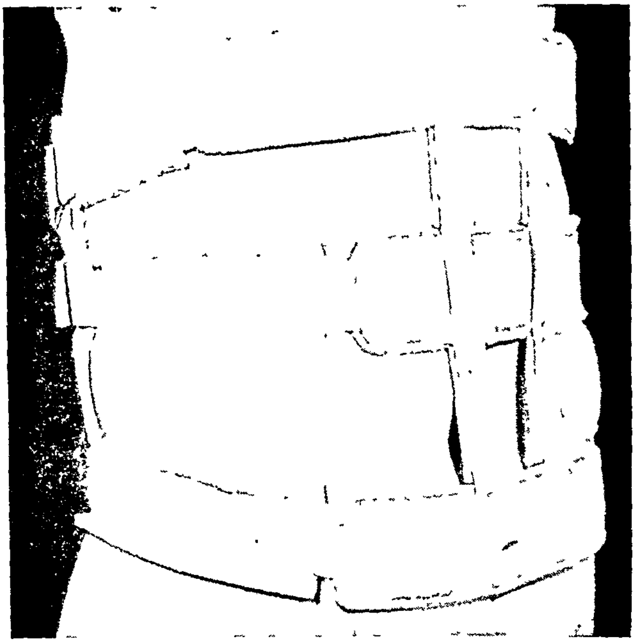

Fig. 2. — Goldthwaite Brace.

There are other braces used for this purpose, such as the Lipscomb brace,[6] the Wilcox brace[7] and chair back brace. The Lipscomb brace (Fig. 3), is more comfortable to wear than the chair back brace as it fits more snugly against the ribs. This brace eliminates lateral flexion. It differs from the chair back brace only in that the upper transverse bar is divided into three separate segments, one for each lateral upright, placed in line with the greater trochanter, and one for the back uprights. All of these are hinged to each other so that they move back and forth. The transverse bar is usually

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[4] Goldthwaite, J. E; Painter, C. F., and Osgood, R. B.: Diseases of the Bones and Joints; Clinical Studies. Boston, Mass., Heath, p 513, 1909

[5] Meyerding, Henry W.. Spondylolisthesis as an Etiologic Factor in Backache, J. A. M. A. 111: 1971, 1938.

[6] Lipscomb, William R.· Personal communication.

[7] Hadden, C. C.: Proc. First Sympos on Orth. Appliances Published by OALM Assn., Washington, D. C., 1948, p. 35 (Wilcox Brace).

This brace permits some extension but no other movement. It is used successfully for correction of dorsal curve and lumbar straightening.

The Callahan spinal brace[9] has essentially the same feature, except that the pads on the sternum and symphysis are connected on the anterior surface of the body by two upright bars of spring steel (Fig. 5). Attached to these bars, around the back, are straps or metal bands, that exert tension on a pad over the spine, pulling or pushing it into hyperextension. This is an efficient brace, affording a means of immobilization in positive hyperextension.

The braces discussed meet the theoretical functional requirements, but, from practical experience, it has been found that some patients cannot stand the pressure on the symphysis necessary to stabilize the brace firmly. If moderate pressure is used, slipping occurs. Also, these braces may be uncomfortable in the sitting position, because the altered inclination of the pelvis, involves a shortening of the distance between the symphysis and the sternum. This causes these braces to exert excessive pressure at their extremities. Because of these factors, other types of braces are used, which give the proper degree of fixation and, at the same time, afford sufficient freedom of motion to permit general everyday activities.

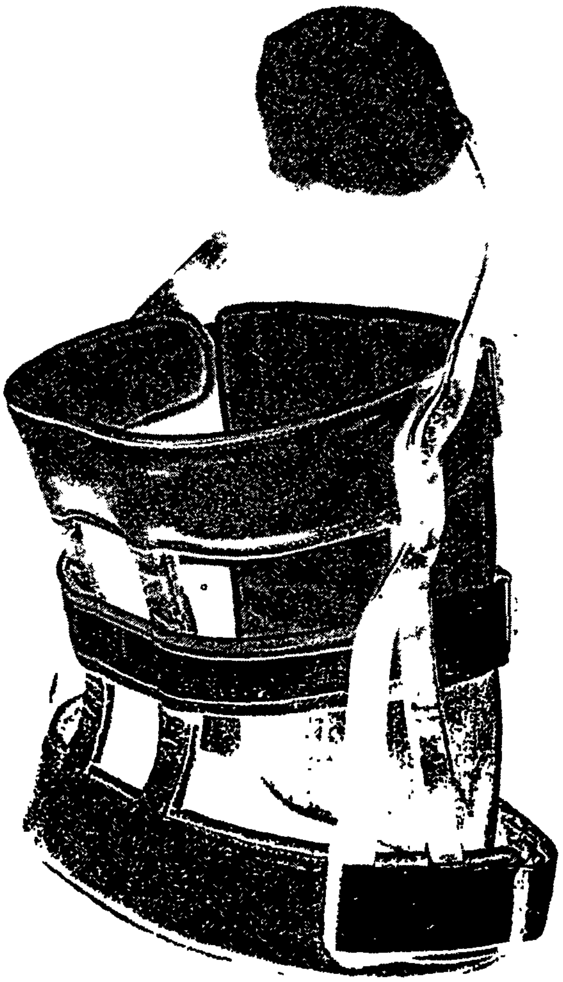

Fig. 6. — Author's Functional Hyperextension Brace.

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[9] Thorek, Max: Modern Surgical Technique (Callahan Brace), Philadelphia, J. B. Lippincott Co., 1949.

I prefer a functional hyperextension back brace,[10] constructed on the same basic principle as the Williams brace (Fig. 6). Essentially, this brace consists of a low chair-back brace, to which is added a removable inverted U-shaped frame, which pivots on both the upright bars at an appropriate level. This level varies with the build of the patient. The apex of the U-shaped frame expands into a chest plate, padded with sponge rubber, and placed over the upper part of the sternum. The lower free ends contain slots and extend to the level of the posterior part of the pelvic band. Webbing or elastic straps, which are attached firmly to the pelvic band, are drawn through these slots, where they are reversed and fastened to the lower part of the abdominal apron or pad. This arrangement permits hyperextension to be con-

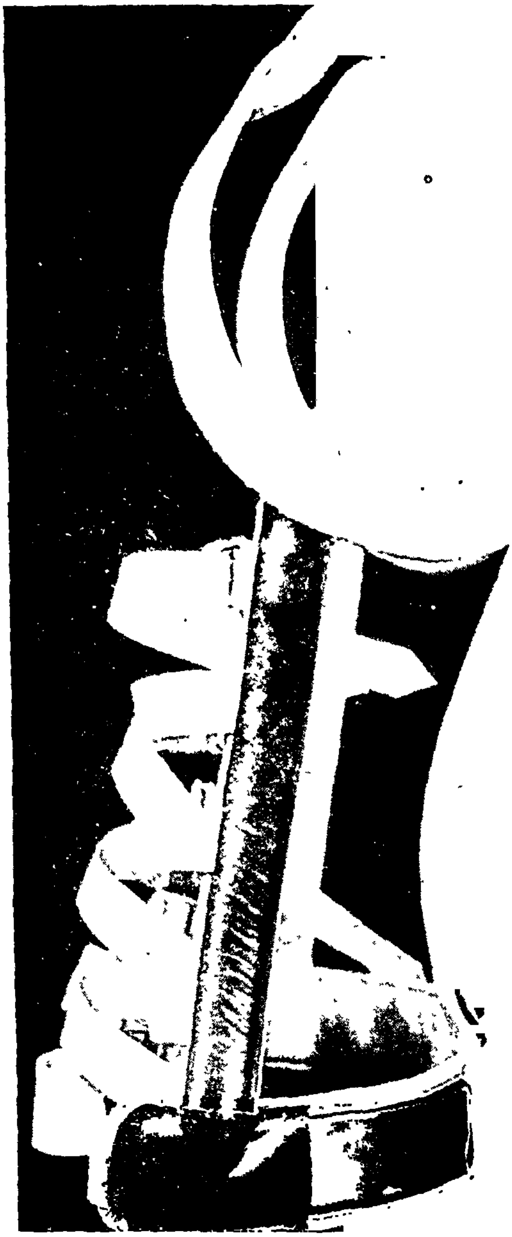

Fig. 7. — Cowhorn Brace.

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[10] von Werssowetz, Odon F.: Functional Hyperextension Back Brace. To be published in J. Bone & Joint Surg.

trolled to the desired degree, and provides adequate stabilization without undue pressure over the symphysis.

Other devices of this type are the so-called Cowhorn and Arnold braces.[11] The principle of these braces is to support the back by pressure on the upper anterior chest, just below the clavicle. The pelvic band in the Cowhorn brace (Fig. 7), is placed at the level of the sacrum. The Arnold brace uses a pelvic section of molded leather. Two back upright bars connect the pelvic part with the upper transverse bar; they are made of spring steel and fit snugly to the contour of the body. The bar clears the axillae and ends anteriorly in circular padded enlargements just beneath the clavicles. In fitting this brace, it is important to make certain that the lumbar and dorsal segments of the spine lie flat against the two uprights. Side motion may be prevented by uprights on each side. The Cowhorn brace differs from the Arnold brace in that the anterior ends of the upper transverse bar come more toward the midline at the sternum and usually are joined by a strap. Because of the mechanical arrangement of these braces, flexion of the spine is impossible.

There are numerous other types of braces used in the attempt to hyperextend the lumbar spine. They are mostly modifications of the Taylor or Knight braces. None of them gives effective functional results because the basic design in these braces is that of a gutter splint. They may be good for immobilizing purposes, but are of little value as functional braces. The main reason for this is that the active kinetic force, essential in a functional brace, is converted into a passive pressure area by the shape and curve of the upright bars. These braces have only one fixed stabilizing point in the pelvic band. From this point, the rest of the support is obtained through the back or side uprights. Because of the poor stabilization of the upper transverse bar, this part of the brace almost invariably pulls away from the body when the patient attempts flexion.

Conclusion and Summary

Probably in no other type of disability is the use of braces abused as much as in painful conditions of the back. As a general rule, in these functional disabilities of the back, a certain amount of muscle imbalance exists. Therefore, the primary treatment objective should be directed toward obtaining a proper balance of muscles controlling and influencing the alignment of the spinal column. It is well to emphasize that muscles will increase in strength only by active use. For this purpose, braces are not only useless but often harmful. Their only justifiable use is to prevent malalignment, produce relaxation of the contracted or spastic muscles, and prevent stretching of the weakened antagonists. In such conditions, braces should be used temporarily and should be coupled with a definite exercise routine for strengthening the weak muscles. They should be discarded as soon as possible.

Basically, the object of functional braces is not to support the body load but to maintain as normal as possible the postural alignment. This should restore the weight bearing stability of the spine and permit the transmission of gravity and weight forces as normally as possible. The brace should preserve the maximal optimal function. The selection of a brace should be based on a careful analysis of the disability and on an accurate calculation of the kind, direction and amount of force required.

All functional spinal braces should be constructed on the three-point pressure system, where two forces are used for stabilization and one for the kinetic force which attempts to correct the disability. All braces should tend to correct the effect of the deflected weight of the superincumbent load, change to normal the inclination angle of the pelvis, and counteract the abnormal action of spinal muscles. The theoretical object is to select a brace so as to provide a firm and yet elastic support without obstructing the circulation or interfering with any of the vital functions or the movements of the body. In practical experience, this may not be obtainable in all cases, though it is important to provide a brace that will least interfere with normal physiological action.

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[11] Arnold, Hubert R.: An Efficient Back Brace, California & West. Med. 46:323, 1937.

Some of the most commonly used braces are discussed as to their proper application, their value in treatment and their contraindications.

Discussion

Dr. Robt. W. Boyle (Ft. Thomas, Ky.): The periodic reminder that the medical profession is relatively impotent in treating many of the most common complaints, such as headache, the common cold, sinusitis, backache of unknown etiology, and many others serves as a stimulus to promote more all out effort on the part of the research clinicians to solve these perplexing problems. Dr. von Werssowetz' paper has brought the problem of backache again to our minds.

Of all the conditions the physiatrist meets, one of the most common is backache. The story as unfolded in the paper just presented is as true today as it was 20 or 30 years ago. Not only that, but our ability to cope with the etiology, prophylaxis and treatment are equally troublesome. The symptomatology and signs are well known and have not changed over the years. The treatment has fallen into a cyclic pattern of conservatism, operative interference, conservatism, operative interference and conservatism. However, a study of the results of such treatment shows equally unsuccessful results in the majority of cases. Today each case must be considered individually and what may help one case certainly may lead to disastrous results in another.

To get on with the basic thesis of this paper one must admire the efforts of Dr. von Werssowetz in attacking the problem of selection of braces for backache. His background discussion of the physics of curvature and its correction is a clear and simple explanation of what a brace should do to correct a given deformity. However, as he points out, it is one thing to know what to do, but a far harder task to do it when there are few or no points of stability to act as anchors for the "three point" pressure system.

When one considers that there may be: (a) soft tissues which will yield to pressure; (b) one or many intermediary joints involved between the three pressure points; (c) bony protuberances just under the skin such as the iliac crests, where pressure sores may develop with such a system; (d) pain produced at the sites of the pressure points; and (e) a mental fixation against wearing the brace in its position of maximum benefit; then, if not long before, the physician might have a tendency to give up the ghost and resort to more drastic and permanent measures such as bone grafting, plaster of paris casting, or referral of the patient to an unsuspecting colleague!

Another aspect of the problem of back bracing is the dependency reaction seen so often in industrial, pension, and compensation cases. Here the patient claims such marked benefits from the use of the brace that he will not give it up long after he no longer has use for it. As a matter of fact, the dependent attitude may lead to sufficient muscular atrophy that the patient finally must either go through a rigid course in muscle retraining and strengthening or continue to wear the brace as a physiologic crutch.

Dr. von Werssowetz is cognizant of this latter possibility, for he points out that the brace must be an adjunct to other good physical medicine procedures, including a goodly amount of strength building exercise, and that the patient must be weaned from the brace as soon as possible.

The fact that there are so many different types and styles of back braces reinforces the adage that each case must be individualized and that without knowing the cause of the backache there can be no universal back brace.

It is obvious that this discussion has skirted around the edges of Dr. von Werssowetz' paper touching only here and there on points of interest to the discussor. It is also equally obvious that the discussor is woefully ignorant of certain orthopedic appliances, when referred to by the names of the originator of the appliances. It is wonderful that we can recognize an outstanding physician by his contribution to his own field of endeavor. It would be equally wonderful if the name of the appliance described what that appliance was or what it attempted to do.

"The author wishes to express his appreciation and thanks to Mr. Wallace Slodek, Chief of the Orthopedic Brace Shop, Thayer VA Hospital, Nashville, Tennessee, who constructed all of the braces pictured, except those in Figures 5 and 7. These were constructed by Mr. Carl G. Albright, Supervisor, Orthopedic Brace Shop, Lawson VA Hospital, Chamblee, Georgia, to whom the author is greatly indebted."

A PORTABLE ELECTRONIC PULSE DETECTOR *

HENRY FLECK, M.D.

NEW YORK, N. Y.

Detection of the arterial pulse in peripheral vascular disease, depends largely upon the sensitivity of the cutaneous receptors of the observer's fingers. Since presence or absence of the pulse might influence a decision in favor of surgical or other intervention, an instrument was devised, the sensitivity of which goes beyond that of human perception, and which permits direct observation.

The problem to be solved was that of transforming a mechanical impulse into an electrical impulse, and to amplify the latter in such a way as to permit registration on a sensitive meter or the electrocardiograph.

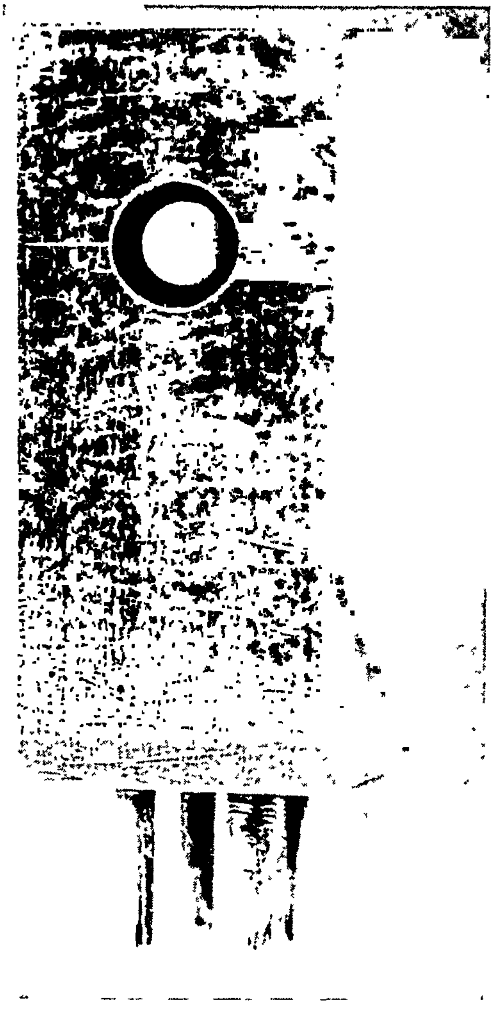

Figure 1.

The apparatus consists of two parts: The pick-up and the amplifier.

(1) The *pick-up* (Fig. 1 and 2) makes use of a mechano-electronic transducer RCA 5734, as used by Curtis and Nickerson.[1] This is encased in a

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* From the Department of Physical Medicine, Bronx Hospital.

[1] Curtis, H. J., and Nickerson, J. L.: Application of the Transducer Tube to the Recording of the Peripheral Pulse, Proc. Soc. Exp. Biol. & Med. 70:383, 1949.

metal holder, one-half of which is cut away at one end, and provided with a hole. Through this hole, slightly below the surface of the holder, projects a plastic knob at the end of a metal stylus, which is soldered at right angles to the plate shaft of the tube.

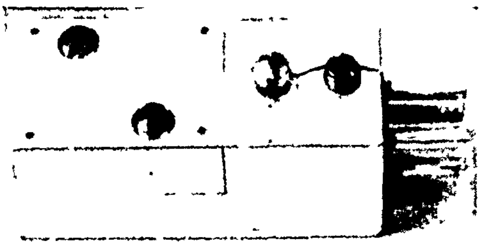

Figure 2.

Any movement of the plastic knob moves the plate in the tube, and thereby changes the electro-static field between it and the cathode. This change, which increases or decreases the plate current, is amplified.

(2) The *amplifier* (Fig. 3) consists of one stage of amplification and a balanced bridge circuit, as indicated in the diagram. Its sensitivity can be varied by means of both input resistors.

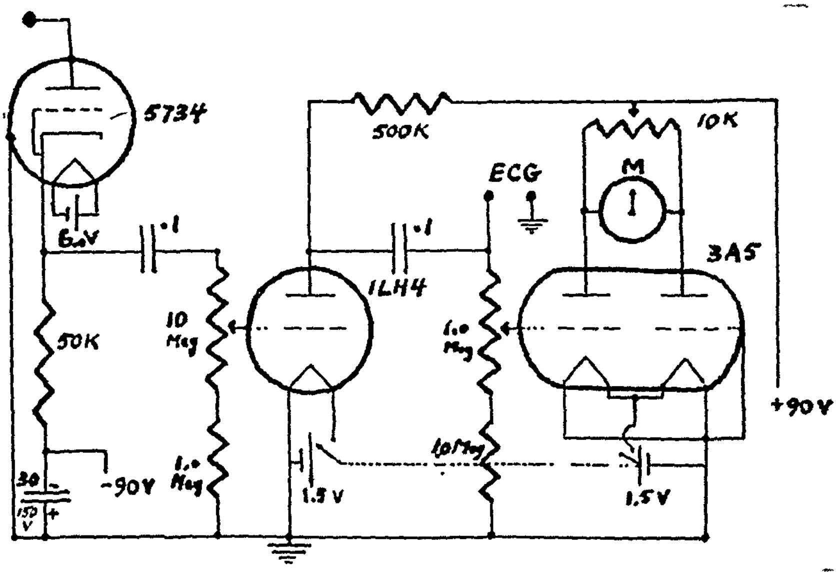

Figure 3.

The pick-up can be moved about until the pulse is found, and then may be strapped to the region where the pulse is to be recorded. The pulse can be observed on the zero center microammeter (M) or the first stage of amplification can be coupled to the electrocardiograph.

The device is portable and its power requirement is small.

MEDICAL NEWS

Members are invited to send to this office items of news of general interest, for example, those relating to society activities, new hospitals, education, etc. Programs should be received at least three weeks before the date of meeting.

New Instructors at Northwestern University Medical School Course in Physical Therapy

Following the retirement of Miss Gertrude Beard as Technical Director of the Course in Physical Therapy at Northwestern University Medical School, after twenty-five years of service, and the resignation of Miss Dorothy Dean, who served as Instructor and Associate in Physical Medicine from 1942-1952, Dr. Stafford L. Osborne, Professor Emeritus and Acting Chairman of the Department of Physical Medicine has announced the following new appointments to the staff:

Elizabeth Wood, former instructor, has been made Technical Director. Miss Nan Dickson of Chicago, formerly Chief Physical Therapist at St. Lukes Hospital and staff Physical Therapist at Wesley Memorial Hospital, joined the staff as full-time instructor on August 1, 1952, and Miss Dorothy Gorski, also of Chicago and from the St. Lukes Hospital Physical Therapy Staff, started as full time instructor on September 15, 1952.

Seminar at Tulane

A seminar on "Low Back Pain" will be given on February 27-28, 1953, at the Division of Graduate Medicine, Tulane University of Louisiana School of Medicine. Inquiries should be directed to Dr. Jack Wickstrom, Chairman, 1430 Tulane Ave., New Orleans 12, La.

TV Films on Physical Therapy

Film sequences were made at the Institute of Physical Medicine and Rehabilitation, New York University-Bellevue Medical Center, to be used in a series of TV programs this fall.

New Jersey Society Meets

At the October meeting of the New Jersey Society of Physical Medicine, Dr. Herman Rudolph spoke on "Physical Medicine and Rehabilitation of Hemiplegia at Home."

Clinics on Cerebral Palsy

Dr. Winthrop M. Phelps will conduct consultation clinics on cerebral palsy on Dec. 4 and 18 at 1767 Massachusetts Ave., N. W., Washington, D.C. The clinics will last from 10 A. M. to 3 P. M.

Personals

Dr. **Robert M. Stecher**, Cleveland, Ohio, is a nominee for Secretary-Treasurer of the newly formed organization known as "Friends of the Armed Forces Medical Library."

Dr. **Howard A. Rusk** of New York City was one of the speakers at the annual meeting of the Association of Military Surgeons held at the Statler Hotel, Washington, D. C., November 17-19, 1952.

Dr. **Edward Gordon** is author of four manuals on multiple sclerosis issued by the National Multiple Sclerosis Society.

Dr. **Ralph E. Worden** is the new director of a rehabilitation center recently established at Ohio State University.

Accepted Apparatus

Kidde Tubal Insufflator, Office Model No. 605700. — Manufactured by Kidde Manufacturing Co., Inc., 35 Farrand St., Bloomfield, N. J., apparatus is for controlled injection of carbon dioxide into the uterine tubes for diagnostic and therapeutic purposes.

The Council on Physical Medicine and Rehabilitation voted to include the device in its accepted list.

Vaso-Pneumatic. — Manufactured by Poor & Logan Manufacturing Company, 7319 Varna Ave., North Hollywood, Calif., apparatus is designed for use in the treatment of peripheral vascular disease. The Council on Physical Medicine and Rehabilitation secured evidence to indicate that the device was well designed and was useful in the treatment of certain types of peripheral vascular disease.

Gynogauge (Weisman). — Manufactured by Goodman-Kleiner Co., Inc., 5 E. 17th St., New York 3, N. Y., device is used for injecting carbon dioxide at controlled pressure into the uterine tubes. Evidence was obtained by the Council on Physical Medicine and Rehabilitation that the apparatus is well made and performs satisfactorily under standard office conditions.

Stafford L. Osborne

It is with regret that we announce the death on October 24 of Stafford L. Osborne, Ph.D. Dr. Osborne was a recipient of the Gold Key and has been closely associated with the Congress for many years. His death resulted from pneumonia.

ARCHIVES of PHYSICAL MEDICINE
OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL MEDICINE

.˙. EDITORIALS .˙.

SIGNIFICANCE OF THE COULTER MEMORIAL LECTURE

The lead article in this issue should prove of exceptional interest to the readers of the ARCHIVES. It is the Second John Stanley Coulter Memorial Lecture, delivered before the 30th Annual Session of the American Congress of Physical Medicine and Rehabilitation by Dr. Frank H. Krusen, for years closely associated with Dr. Coulter. The lecture honoring John Stanley Coulter revives in our memories his outstanding accomplishments. Through tireless and indefatigable labors, he did much towards the establishing of physical medicine on a sound scientific basis and bringing about its acceptance as a recognized medical specialty.

The present lecture is more than a tribute to a great physiatrist. It is a contribution to better understanding among physicians of their international responsibility. Dr. Krusen devoted his address to a delightful and informative account of the proceedings of the International Congress of Physical Medicine and Rehabilitation held in England last July. The meeting, conducted with a dignity traditionally British, was conspicuous for the excellence of the scientific contributions and discussions. It also exemplified the unfailing courtesy and abundant hospitality of the English hosts. The formation of such an International Congress was dear to the heart of Dr. Coulter. What satisfaction he would have experienced, could he have lived to see the fulfillment of one of his dreams!

With unrest throughout the world straining the relationships of nations almost to the breaking point, such a scientific gathering takes on added significance. Science knows no barriers, neither geographic, racial nor political. Mutual interchange of knowledge continues to be the most potent medium for maintaining good will among the peoples of the earth. Even between the nations of the West and those isolated behind the "Iron Curtain," the common bond of scientific thought remains a still effective means of contact, albeit a tenuous one. It is heartening to all who seek peaceful understanding of the difficulties and problems that beset nations that plans have been made for additional countries to sponsor future International Congresses of Physical Medicine and Rehabilitation.

EDUCATIONAL PROBLEMS OF PHYSICAL THERAPY

The demand for qualified men and women properly trained in the professional and technical aspects of physical medicine and rehabilitation continues unabated. Governmental and state agencies as well as privately controlled civilian institutions suffer alike from the shortage that exists in personnel experienced in this field.

The lack of physicians competent to direct Departments of Physical Medicine and to train others in this specialty has been the subject of editorial comment in this journal on several occasions. In this connection mention should be made of a plan recently developed by the National Foundation for Infantile Paralysis whereby undergraduate summer internships in physical medicine were made available to third year medical students. Of necessity only a small number of students were able to take advantage of this opportunity. The results obtained last summer, the first during which this arrangement was operating, have been most encouraging. Those who observed the work and reaction of the participating medical students are in agreement that this educational innovation has done much to arouse in them greater interest in and better understanding of physical medicine and its indispensable role in rehabilitation. Future recruitment of physiatrists depends primarily upon the creation of enthusiasm for this specialty during the period of undergraduate training. Thanks are due the National Foundation for its pioneer effort.

The interest of the physiatrists cannot be restricted to their professional colleagues in physical medicine. They must be equally concerned with the enrollment and training of non-medical personnel needed to fill the ranks of the physical therapists. The position of those who specialize in physical medicine is unique in that they depend in no small degree upon the assistance of qualified physical therapists to carry out the treatments which they prescribe. The lack of expert technical help undeniably impairs efficiency in patient management. Therefore, from the standpoint of professional efficiency alone the need for physical therapists is obvious. In this respect a rough analogy may be drawn between physical therapists and x-ray technicians. The roentgenologist, like the physiatrist, relies upon efficient technical assistance. There is, however, an important difference between the duties of x-ray technicians and physical therapists. The latter are required not only to carry out technical procedures but frequently are called upon to assist in the education and training of patients. This is notably true in the rehabilitation of those suffering from poliomyelitis, cerebral palsy, hemiplegia, paraplegia and amputations, to mention only some of the commonly met conditions. Consequently, physical therapists play a definite role in actual treatment. Furthermore, therapists often are responsible for carrying out prescribed treatments during the intervals between the doctor's visits. In view of this situation physiatrists must be concerned not alone with the much needed numerical increase in physiatrists, but, also, with maintenance of the educational standards in our schools for physical therapists. These standards have been brought to their present high level only after years of thoughtful effort. The need for physical therapists is not a valid reason for lowering the educational prerequisites for admission to our schools for physical therapy nor for weakening their basic curricula. The best interests of patients, physicians and physical therapists are safeguarded by insistence upon an adequate general education as a preliminary to thorough technical training of those who enter physical therapy.

Physicians who hold positions as directors or medical directors in many of the Schools for Physical Therapists have an unescapable responsibility for the training programs of their schools. They in particular should acquaint themselves with an excellent discussion carried on at the special meeting of the Physical Therapy Directors held during the American Physical Therapy Association Conference last summer. At that time, a thought provoking report on some of the Problems of Physical Therapy Schools was presented by Miss Catherine Worthingham, Director of Professional Education of the National Foundation for Infantile Paralysis.

Miss Worthingham stresses the dangers inherent in a two year educational prerequisite for admission to a one year course in physical therapy. She cites convincing figures to show the present definite trend toward the degree course. In 1945 only seven out of thirty-two physical therapy schools, eight of which were conducted by the Army, offered degree courses. In 1952, twenty out of twenty-eight approved civilian schools are conducting courses leading to a degree.

Miss Worthingham shares the view that even the great need for physical therapists does not justify widespread advocacy of the two year college prerequisites for a certificate course in physical therapy, especially since at present only three schools admit students on that basis. Nor does she believe that elevation of educational standards has decreased the numbers graduating from our schools. In support of this contention she points out that from sixteen approved schools in 1941 there were 238 graduates and the total number of registered physical therapists was 1,604. After the war, in 1947, there were 383 graduates from twenty-three schools. The total number of physical therapists had risen to 4,684. At the end of a ten year period (1951) twenty-eight schools graduated 585 students and the physical therapists numbered 6,754. Thus, in a decade, the number of approved schools had almost doubled; the graduates per year had more than doubled and there were four times as many physical therapists available. We agree with her comment that "this is a good record for any profession."

Further expansion of existing teaching programs and the initiation of adequate new programs in physical therapy is imperative. This is so because it is estimated that by 1958 at least 7,500 more physical therapists will be needed. To meet this demand 10,700 will have to be educated by that date. Since the present maximum capacity of the approved schools is approximately 777, to carry out this expanded educational program involves doubling that number of graduates. Such an undertaking presents many difficult problems.

As the concept of total rehabilitation of the patient continues to gain acceptance among physicians, particularly general practitioners, the future demand for qualified physical and occupational therapists will increase. Therefore, not only physiatrists but the entire medical profession must help meet this situation and become concerned with stimulating recruitment in and the educational advancement of these technical groups

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BOOK REVIEWS

The reviews here published have been prepared by competent authorities and do not necessarily represent the opinions of the American Congress of Physical Medicine and Rehabilitation.

HOW TO SLEEP WITHOUT PILLS. By *Dr. David F. Tracy.* Introduction by *T. S. Welton,* M.D. Second Edition. Cloth. Price, $1.00. Pp. 62, with illustrations. Sterling Publishing Co., Inc., 141 E. 44th St., New York 17, 1951.

The qualifications of the author of this book are not made clear on the title page, which fails to state his address and institutional connections. The text itself offers, mixed with a large proportion of the plausible and the undeniable, enough dubious material about hypnotism and auto-suggestion to make the cautious reader wonder just what is behind this book. The author states (page 10) that a patient will awaken more rested after an hour of hypnotic sleep than after hours of usual restless sleep, and (page 56) that a hypnotist can make one remember things that happened when one was three years old. His opinion of current science is revealed by a reference to "scientific and superstitious mumbo jumbo" on page 6; he seems not to realize that "scientific mumbo jumbo" is a contradiction in terms that will be resented by everyone earnestly desiring the advancement of science. This book is not recommended.

ADVANCES IN ENZYMOLOGY AND RELATED SUBJECTS OF BIOCHEMISTRY. Volume XII. Edited by *F. F. Nord.* Cloth. Price, $9.75. Pp. 570, with illustrations. Interscience Publishers, Inc., 250 Fifth Ave., New York 1; 2a Southampton Row, London, W.C.1, 1951.

Editor Nord of Fordham University has presented an authoritative work which has been written by twelve of the ablest men in this discipline. Each writes a chapter on the subject in which he is an acknowledged master. While this volume will have its greatest appeal to the biochemist and physiologist, it will have a limited appeal only to those physicians who have an interest in this subject.

Robert Hill of Cambridge, England, writes a chapter on oxidoreduction in chloroplasts which is concerned with the biochemical knowledge we have at the moment of the nature of the green plastids of plants. Utter and Wood of Western Reserve have written on the fixation of carbon dioxide. Their discussion is limited to the mechanisms of synthesis of the carbon skeletons of the various compounds from carbon dioxide. The subject of enzyme-subtrate compounds is written by Britton Chance of Philadelphia, who discusses the nature and properties of these compounds. Emil Smith of Salt Lake City writes a chapter on the specificity of certain peptidases. Nachmansohn and Wilson of New York write on the subject of enzymic hydrolysis and synthesis of acetylcholine. Their review is limited to the presentation and analysis of a few important features and of some recent advances of interest for the enzymologist. Kurt Meyer of Geneva, Switzerland, writes a chapter on the present status of starch chemistry which is concerned only with natural starch and its constituents. Peter Bernfeld of Tufts writes a chapter on enzymes of starch degradation and synthesis and states that this depends more than most other enzymic reactions on the peculiarities of the substrate. Biological methylation is the subject of a chapter by Frederick Challenger of Leeds, England. Charles Little writes on the reactions of borate with substances of biological interest. Each of the nine chapters is closed with an extensive and valuable list of references for more detailed study. There is also an author and adequate subject index. In addition there are included both an author and subject cumulative index for volumes one to twelve.

This volume is highly recommended to the biochemist or the physician who has a particular interest in this field.

THE FACTS OF LIFE FROM BIRTH TO DEATH. By *Louis I. Dublin,* Ph.D., Second Vice-President and Statistician, Metropolitan Life Insurance Company. In Collaboration with *Mortimer Spiegelman,* F.S.A., Assistant Statistician Metropolitan Life Insurance Company. Cloth. Price, $4.95. Pp. 461. The Macmillan Company, 60 Fifth Avenue, New York 11, 1951.

Dr. Dublin's aim is to convey succinct information on problems of human health and disease. This he is well equipped to do. The material is arranged in the form of question and answer. The questions are well chosen and the answers sober, factual, and discreetly evaluative; the information is given at the level of the intelligent lay reader; sources of more detailed information are noted. The arrangement is not conducive to consecutive reading, but this is proper in a book intended for reference.

It will be useful in any doctor's office and, in fact, in the office of anyone who deals with some phase of public health; it will probably fascinate those laymen who have an overweening curiosity about disease. The title embodies the only distinguishable witticism.

TUMORS OF THE SKIN: BENIGN AND MALIGNANT. By *Joseph Jordan Eller*, B.S., M.D., Director of Department of Dermatology, New York City Hospital, New York, and *William Douglas Eller*, M.D., Assistant in Dermatology and Syphilology, University Hospital, New York-Bellevue Medical Center, New York. Second Edition. Cloth. Price, $15.00. Pp. 697, with 553 illustrations. Lea & Febiger, 600 S. Washington Sq., Philadelphia 6, 1951.

In this volume by Eller and Eller (Lea & Febiger, Philadelphia), the authors have divided the subject matter into three major sections: general considerations, benign tumors, and malignant tumors. Under the second section, some 48 benign growths, 5 of infectious origin and 19 instances of precancerous dermatoses are described and classified clinically and histologically. Methods of treatment that offer the best prognosis and cosmetic results are presented in detail. The section on malignant tumors is unusual in that the treatment of carcinomas of various types in special locations is diagrammed and the practical application of different methods of therapy is described for each lesion. A chapter concerns the management of malignant melanoma. Other malignant lesions discussed include thirteen sarcomas of different types and origin, and seven lymphomas, including the leukemias. Chapters are devoted to cutaneous surgery and plastic repair of the skin tumors and extensive discussion of the application of radiotherapy includes a number of dosage tables and diagrams. The text has been expanded and brought up-to-date; several new disease entities have been added. There is an extensive bibliography at the end of each chapter and the subject matter is well indexed. This book will prove a useful reference for dermatologists, radiologists, surgeons, and others interested in tumors of the skin.

DISEASES OF THE NERVOUS SYSTEM. By *W. Russell Brain*, D.M., F.R.C.P., Physician to London Hospital and to Maida Vale Hospital for Nervous Diseases. London. Fourth Edition Cloth. Price, $8.50. Pp. 1002, with 85 illustrations. Oxford University Press, 114 Fifth Ave., New York 11; Amen House, Warwick Sq., London, E.C.4, 1951.

This is a fourth edition of this text since 1933. The most notable additions since the third edition are discussions of the use of new drugs for tuberculous meningitis, subacute combined degeneration, epilepsy and Parkinson's disease.

This is an excellent text for students and for reference use for the practicing physician. Anatomical relationships, and aspects of functional neurophysiology are incorporated into the clear clinical descriptions of neurological syndromes to help the clinician in diagnosis. Pathology is briefly discussed, but references are included. Prognosis is described in general terms together with specific treatment when such is known. The use of physical medicine and rehabilitation procedures is not included in sufficient detail to help the physiatrist.

BIOLOGICAL EFFECTS OF EXTERNAL BETA RADIATION. Edited by *Raymond E. Zirkle*, Professor of Radiobiology, Institute of Radiobiology and Biophysics, University of Chicago, Chicago. National Nuclear Energy Series: Manhattan Project Technical Section. Division IV: Plutonium Project Record, Volume 22 E. Cloth. Price, $3.25. Pp. 242, with illustrations. McGraw-Hill Book Company, Inc., 330 W. 42nd St., New York 18; Aldwych House, Aldwych, London, W.C.2, 1951.

Biological effects of external beta radiation is one volume of a series giving a record of the research work done by the Manhattan Project and the Atomic Energy Commission. The declassified portion of the National Nuclear Energy Series, when completed, is expected to consist of some sixty volumes which will be grouped into eight divisions. A Project Editorial Advisory Board was designated to prepare a unified account of Atomic Energy Project work. For reasons of national security there was considerable duplication of effort. The Editorial Board has attempted to reduce duplication insofar as possible and to eliminate discrepancies in factual data.

This volume is a technical account of information collected while developing methods for producing plutonium. These papers represent selections from the great mass of current reports, made on the basis of their value to basic science and technology. The work was part of an intensive radiobiological program carried out during World War II at Clinton Laboratories, Oak Ridge, Tennessee, under the supervision of Dr. Howard J. Curtis.

Doctor Zirkle has had a most difficult task as editor of this volume. Most of the writing had to be done hastily because the authors were returning to their pre-war positions. The shortage of manpower made it impossible to edit manuscripts as carefully as desirable. Nevertheless, Doctor Zirkle deserves great credit for a difficult task well done. Contributing authors were Elizabeth Anderson Barnes, K. K. Barnes, Purdue University; P. S. Henshaw, Public Health Service, Washington, D. C.; J. R. Raper, University of Chicago; E. F. Riley, Jr., State University of Iowa; R. S. Snider, Northwestern University Medical School; J. E. Wirth, Pasadena, California; and R. E. Zirkle, University of Chicago.

There are sixteen chapters. Chapter one gives the sources and techniques that were developed to administer external beta-ray exposures to various biological materials. The experiments consisted of a study of: 1, acute total-surface irradiation of mice, rats, guinea pigs, and rabbits; 2, daily low-dose exposure of mice and rats; and 3, irradiation of restricted areas of rabbit and man. Both early and delayed effects were studied while lethal action was studied intensively. The lesions are well illustrated by photographs, many of them in color. Each chapter opens with an excellent abstract which is most helpful. Each chapter is closed with a well chosen list of references for further study. The work is well presented in clear and concise language. This is a most useful volume and is undoubtedly but the starting point to new reaches of knowledge.

CURRENT THERAPY, 1952. LATEST APPROVED METHODS OF TREATMENT FOR THE PRACTICING PHYSICIAN. Editor, *Howard F. Conn,* M.D. Consulting Editors, *M. Edward Davis, Vincent J. Derbes, Garfield G. Duncan, Hugh J. Jewett, William J. Kerr, Perrin H. Long, H. Houston Merritt, Paul A. O'Leary, Walter L. Palmer, Hobart A. Reimann, Cyrus C. Sturgis,* and *Robert H. Williams.* Cloth. Price, $11.00. Pp. 849. W. B. Saunders Company, West Washington Square, Philadelphia 5, 1952.

This is an amazing compilation of authoritative opinion on treatment by recognized specialists. Correct diagnosis is assumed and the presentations are confined to well condensed, often outlined discussions of necessary and medicinal, dietary and nursing orders. The most detailed consideration is in regard to administration of drugs. In case of controversial methods of treatment, alternative opinions are given without editorial comment.

This would appear to be an extraordinarily valuable desk reference for the busy general practitioner and for medical students and hospital resident staffs.

Surgical, psychiatric and physical medicine and rehabilitation procedures are essentially omitted except for brief reference.

A SYNOPSIS OF NEUROLOGY. By *W. F. Tissington Tatlow,* M.D., M.R.C.P. (Lond.), Medical Registrar, Maida Vale Hospital for Nervous Diseases, London; *J. Amor Ardis,* M.D., Ch.B., D.P.M. (Brist. & Lond.), Senior Registrar in Psychiatry, Aberdeen General and Mental Hospitals; and *J. A. R. Bickford,* M.R.C.S., L.R.C.P., D.P.M. (Brist.), Senior Registrar in Psychiatry, Maryfield Hospital, Dundee, and Dundee Mental Hospital, Gowrie House. Cloth. Price, $6.50. The Williams & Wilkins Company, Mt. Royal and Guilford Avenues, Baltimore 2, 1952.

For some reason Neurology has a reputation of being a difficult subject. It is possible that this book will do much to change that impression, for it is ideal for student use. There is a wealth of anatomical, physiological and clinical data presented, with a minimum of words and a number of clear diagrams. The outstanding feature of the text is its style of presentation in outline form. This allows for a maximum of detailed information with a minimum of reading; in fact, it represents in all likelihood the ideal manner of answering written specialty examination questions and consequently should appeal greatly to all studying for examinations. The reviewer's excellent impression of the book is in part due to the contrasting type, enabling the reader at a glance to determine the essential content of each page. In a sense this is a manner of spoon-feeding the student as the authors have predigested the subject under discussion and skilfully abstracted the essential kernels for consumption. This will undoubtedly be a very popular text for students of neurology; it will also be a valuable addition to the library of the specialist in the field and to all practitioners as a handy reference.

THE PHYSICIAN AS MAN OF LETTERS, SCIENCE AND ACTION. By *Thomas Kirkpatrick Monro,* M.A., M.D., LLD., Emeritus Regius Professor of Practice of Medicine in the University of Glasgow, Honorary Fellow of the Royal Faculty of Physicians and Surgeons, Glasgow; Honorary Member of the Royal Medico-Chirurgical Society of Glasgow; Honorary Member of the Association of Physicians of Great Britain and Ireland. Second edition. Cloth. Price, $4.50. Pp. 259. The Williams & Wilkins Co., Mt. Royal and Guilford Aves., Baltimore 2, 1951.

This book consists of 25 chapters describing the lives of physicians who attracted attention for their activities in such non-medical fields as literature, science, exploration, government and philanthropy. Each of the persons mentioned is represented by a succint biography, and the result is a collection of facts at once illuminating and inspiring. The last chapter, "Some Students of Medicine Who Never Qualified," gives amusing facts about a remarkably long list of famous men. The author is to be commended for avoiding the breathless, exaggerated style by which occasional modern authors try to enliven medical subjects for popular consumption; his wealth of objective information speaks for itself. It is hard to imagine any type of reader who would not find something in this book to enjoy.

ELEMENTARY MEDICAL STATISTICS. THE PRINCIPLES OF QUANTITATIVE MEDICINE. By *Donald Mainland,* M.B., Ch.B., D.Sc., F.R.S.E., F.R.S.C. Professor of Medical Statistics, Division of Medical Statistics, the Department of Preventive Medicine, New York University College of Medicine. Leatherette binding. Price, $5.00. Pp. 327 with illustrations. W. B. Saunders Company, West Washington Square, Philadelphia 5, 1952.

Shorter, and much less formidable in appearance, than the classic "Medical Biometry and Statistics," by Raymond Pearl, the present book by Mainland has many of the best qualities of the older work. These include especially a warm directness of style and perhaps even a keener understanding of the interests of a medical student. The introduction of the theory of probability in many textbooks by references to penny-tossing has become conventional and ineffective; instead, from the first page on, the present author refers to medical experience and publications. This will be appreciated by readers who seek an understanding of underlying principles. It is not a complete treatise on statistical theory; neither is it a cook-book to be followed in working out technical procedures like the calculation of a correlation coefficient. It can be recommended to instructors as an authoritative and interesting basis on which to build up a brief course on statistics for first- or second-year medical students.

PHYSICAL MEDICINE ABSTRACTS

Parkinsonism. Hugh G. Garland.

Brit. M. J. 1:40 (Jan. 19) 1952.

Parkinsonism is an irreversible process, and no patient has ever been cured. A small proportion of postencephalitic cases become stationary for very long periods, and perhaps indefinitely, but all other forms of Parkinsonism are inevitably progressive sooner or later, though often with stationary phases.

Physical therapy probably is as important as medicinal treatment. The essential part of physical therapy is vigorous active exercises employed for all limbs, and in the very advanced Parkinsonian daily passive movements of all joints are essential. Hot baths often will relieve the disability in the joints and to some extent the general stiffness. Massage, all forms of electricity, and all emanations have no particular value in the disease.

The Painful Shoulder. R. J. W. Withers.

Brit. M. J. 1:40 (Jan. 5) 1952.

For rupture of the supraspinatus tendon, conservative measures are adopted in all cases, and the arm is put at complete rest either in an abduction shoulder splint or else with the arm at the side in a sling or bandaged to the chest wall. If there is return of some shoulder elevation within four to six weeks conservative measures can be continued and physical therapy and exercises will complete the return of shoulder function. When no recovery of elevation has occurred in six weeks, operation to repair the ruptured supraspinatus is advised. The aftercare consists of rest for the shoulder with the arm in a comfortable position — the author does not now use an abduction splint — until pain and joint irritability have subsided; thereafter active exercises aided by hot packs and assisted movements from the physical therapist are used.

When a painful arc of movement during midelevation of the shoulder has developed, conservative measures are adopted at first; these consist in teaching the patient how to avoid if possible those movements which cause pain. Repeated injections of procaine into the subdeltoid bursa also help, but it is difficult to see how physical therapy in any form can affect lasting change. About five out of every six cases eventually clear up whether "treated" or left to their own devices. The remainder should be treated surgically.

Patients with "frozen" shoulder should be divided into the subgroups of (1) irritative lesions, where there is a full range of passive movements, and (2) adhesive lesions, where movement is restricted though it can be freed by manipulation.

Treatment of irritative lesions is primarily by rest, support of the arm in a sling being easiest for the patient. There are no real advantages in keeping the arm in an abduction shoulder splint; instead, this often increases pain. Heat in one of its various forms usually is ordered, but in a considerable number of cases this treatment may increase the pain and have to be stopped. If complete rest is given to the shoulder, the severe pain gradually subsides in four to six weeks, and as soon as this occurs gentle exercises for the shoulder should be encouraged, aided if need be by massage. Exercises are best done with the patient in supine position. In the average case return of function may be expected in three to four months, though it will not be full for eight months or even a year in the worst cases.

In many cases replacement fibrosis occurs after the acute irritative stage has passed. At this stage pain is much less severe and usually occurs only on attempted movement. While the shoulder is still "frozen," there is a little movement at the shoulder-joint, so that, along with the scapular glide, the arm usually can be elevated by the patient to about a right-angle. At this stage manipulation of the shoulder under anesthesia is called for, when full movement usually can be obtained with palpable or even audible "snaps" which are due to the breaking down of adhesions. The manipulation must be carried out very gently, and, as a first measure, should be through full lateral rotation only. Often one manipulation is enough to free the joint, and it is usually found that after manipulation physical therapy is a real help in hastening full recovery.

Neurovascular Syndromes of the Shoulder Girdle. F. Stanley Morest.

J. Kansas M. Soc. 53:57 (Feb.) 1952.

There are four main types of anatomic derangement of the shoulder girdle which may be responsible for neurovascular syndromes involving the upper extremities; namely, the cervical rib, scalenus anticus costoclavicular and hyperabduction syndromes. After correct diagnosis, treatment often brings dramatic relief. Keeping the arm out of faulty position often is sufficient to relieve the pain. In analyzing the activities of a patient over a 24-hour period, any faulty position assumed during work, play or sleep, as the particular case illustrates, must be corrected. Frequently, as in mechanics working with arms overhead, it will be necessary for them to change jobs, or omit a portion of the work responsible for using the arm in a faulty position. A change in sleeping position often is necessary. Supplemental measures are designed to increase the angle formed between the clavicle and first thoracic rib by exercises designed to strengthen the so-called "elevator muscles" of the shoulder girdle, like the trapezius and elevator scapulae. Wright has outlined helpful exercises, such as shrugging of the shoulders forward and backward while holding a five-pound weight in each hand. Reaching exercises are carried out by the patient hanging from a horizontal bar or by extending arm upwards overhead and placing a mark on a door or wall. The patient tries to exceed his mark by one-fourth inch daily. These patients must be warned to begin with only three times for each exercise and to progress by one more time daily, thus avoiding induction of any muscle strain. Likewise, increasing gradually the amount of the weight held in each hand, it will be possible to go from 5 to 20 pounds in several weeks, if necessary. If the patient is guilty of faulty body posture as well, it also must be corrected.

Control of Cold in Industry. A. K. Hill.

Brit. J. Phys. Med. 15:37 (Feb.) 1952.

A virus is now accepted as the essential cause of what is called the common cold; but little is yet known of the properties of the virus itself, or of the factors which are related to human resistance or susceptibility to infection by the virus. It is Hill's opinion that the most hopeful method of controlling the common cold is by general hygienic measures, supplemented in some cases by physical or chemical techniques. There are, however, several prophylactic measures which have been used extensively, but with what success is still being argued. Special measures include ultraviolet irradiation, vaccines and vitamins. Exposure to ultraviolet light, in short repeated courses or regularly during the winter months, has many advocates and is much used in industry. Of four methods of prophylaxis tried, this was the only one which reduced both the severity and the number of colds in a large factory. Such exposure may be of value in raising the level of general physical fitness, but the reports on its value in preventing colds are very conflicting. The number of victims of colds who are sun-tanned and physically fit after a recent holiday has greatly reduced the faith which Hill did have in the prophylactic value of ultraviolet light. It is his impression that no purely prophylactic measure is of proved value when applied generally to large numbers of persons, but that in selected cases, one or the other method may be successful.

Rehabilitation Techniques with Braces and Crutches: IV. Methods of Falling and of Getting Down and Up from the Floor. Morton Hoberman, and Erbert F. Cicenia.

Am. J. Phys. Med. 31:21 (Feb.) 1952.

Most of us have an inherent fear of falling. Practically all disabled persons have a fear of loss of support and falling. Although we cannot expect to conquer these fears completely, we can do much to promote a calm self-assurance and to quicken our presence of mind in situations where the inherent fears come into play. Physically disabled persons can be taught the "know how" through adherence to simple safety measures and by early instruction in the proper way to ease a fall. The cardinal safety measure is a progressive approach from the simple to the more difficult. If the preliminary fundamentals are well learned, the danger of falling will be minimized to only unpredictable hazards encountered during the course of a normal day. Instruction in falling should be begun early in the individual's rehabilitation program, even before braces and crutches are used. Falling always should be practiced on well-padded surfaces, such as a soft mat, mattress, or if outdoors, on a soft heavily-grassed spot. This installment of rehabilitation techniques dealing with braces and crutches outlines methods of falling and of getting down and up from the floor. Several methods are described and reinforced by excellent illustrations. The more techniques achieved, the greater the ability to maneuver the body under all circumstances. The methods described in this article are mainly for patients with complete or partial paralysis of the lower trunk and both lower extremities. However, with some ingenuity, these methods can be modified for those patients with more involved residual physical disabilities.

Influence of Procaine Infusions on the Temperature of Muscle and Skin of Poliomyelitis Patients. Steven M. Horvath; Harold N. Taylor; Attie Y. Werner, and W. D. Paul.

Am. J. Phys. Med. 31:14 (Feb.) 1952.

Forty patients with acute poliomyelitis were given intravenous infusions of procaine. Peripheral vasodilatation as indicated by elevated toe temperatures was observed in only 17.7 per cent of these patients. The mean temperature elevation in noninvolved and involved muscles was approximately 0.2 C. This increase cannot be considered to indicate an augmented blood flow through the muscles. The temperature of the gastrocnemius muscle of the involved extremity was lower than in the noninvolved extremity and appeared to be, at least, casually related to the degree of involvement.

After-Care for the Poliomyelitis Patient. Morton Hoberman.

New York State J. Med. 52:323 (Feb. 1) 1952.

After-care for the poliomyelitis patient following hospital discharge is an aspect of total care which has not received sufficient emphasis. Perhaps some of the indifference to this phase of the disease is due to a lack of appreciation of what adequate after-care entails. It may also be related to an oft-repeated statement attributed to Bennett, to the effect that nearly all poliomyelitis patients exhibit 80 per cent of their eventual maximal return of muscle strength within nine months after onset, and the impression that after eighteen months no further increase in muscle strength can be expected. Another possible reason results from a concept that, after discharge from the hospital, only functional activity is of importance and is sufficient to bring the affected musculature to its greatest strength and endurance. After-care for the poliomyelitis patient is a long-term program, whether the patient is mildly, moderate, or severely involved. As might be expected, the moderately and severely involved poliomyelitis patients usually receive more thorough after-care for longer periods than do the so-called non-paralytic and mildly involved patients. This is unfortunate, since it cannot be emphasized too strongly or too often that deformities, contractures, and other undesirable residuals can and do, in fact, occur in any phase or period of the disease as well as in any type of patient. Also, the vastly superior numbers of the latter type of patients (non-paralytic or mildly involved) make it imperative that they be followed carefully for sufficiently long periods after discharge from the hospital.

Chronic Rheumatoid Arthritis. Euclid M. Smith.
South M. J. 44:925 (Oct.) 1951.

The therapeutic approach to this complex syndrome is extremely difficult and should be undertaken only after a thorough study of each individual patient. After sufficient data have been assembled and evaluated, a plan of therapy should be developed which will meet the individual requirements of the patient and maintain the individual in the best possible state of physical and mental fitness until complete rehabilitation has been attained. Adequate nutrition is essential. Physical and mental rest, rest balanced with exercise, are needed. The relief of pain and the prevention and correction of deformities are all important objectives of therapy. To attain these objectives there is available a goodly number of reliable therapeutic agents comparatively simple in their application, and in the hands of an experienced therapist they are of proven value. Drugs for relief of pain, improved nutrition, functional management, psychosomatic methods, orthopedic treatment, climate and spa therapy, and physical medicine, all are reliable therapeutic measures, and when properly applied are most effective in relieving symptoms and in controlling the clinical course of the disease. Even the most enthusiastic interpretation of all recorded observations in this field must lead to the conclusion that there is no specific therapy for rheumatoid arthritis.

The Restoration of Function by Tendon Transplantation in the Upper Limb. R. B. Zachary.
Brit. J. Phys. Med. 14:277 (Dec.) 1951.

No muscle should be transplanted if it is weak for, in its new situation, its action will be less powerful than ever. If a recovering muscle is to be transplanted every effort should be made to strengthen its action before operation; for example, if there has been a lesion in continuity of the ulnar nerve at the same time as an irreparable radial nerve injury, it is useless to use the flexor carpi ulnaris as a transplant before it has recovered almost full strength. Vigorous exercises in flexion and ulnar deviation of the wrist, accompanied by faradism to the flexor carpi ulnaris may help to reduce the delay before operation. Moreover, it is probable that such exercises may enable the patient to control the action of this particular muscle, so that after transplantation reeducation may be made easier. Perhaps the most important feature of the preoperative treatment is to ensure that there is free movement over the range of action which is to be regained. If joint stiffness has occurred, frequent and vigorous and long continued treatment by active and passive exercises and elastic traction is needed, and even capsulotomy may be necessary. The first and most important consideration of the postoperative treatment is to keep the limb in a satisfactory position during the time required for union of the transplant with the recipient tendon. The hand is put in a plaster cast for the first three weeks. After removal of this, an anterior plaster slab is then applied in the same position and reeducation is commenced. During the first week the plaster slab is removed for exercises starting first with the effect of gravity eliminated and then gradually adding the effect of gravity and increasing the duration of the exercises. Faradic stimulation of the transplanted muscle may help reeducation. Tendon transplantation is a valuable method of improving the function of the limb, but the treatment must be planned with caution and carried out with care. There are few procedures which demand such understanding and close cooperation between patient, physical therapist and surgeon.

The Mechanism and Physiotherapeutic Relief of Pain. Clive Shields.
Lancet 6681:459 (Sept. 15) 1951.

Pain is hard to define. The lexicographers and the poets are singularly unhelpful, for they invariably contrast pain with pleasure; but, since pleasure is an emotion, and pain is perceived through the senses, the two experiences are in no way comparable. Those who are concerned with the treatment of postural defects in children must have been impressed by the infrequency with which such patients complain of pain; whereas in the adult with these conditions it is generally pain that compels him to seek medical advice. It is noteworthy also that the localization of pain by children is very inexact. Precision in locating pain comes with the passage of years, and this can be due only to the storing of past experiences. Suggestion is used in the physical therapeutic relief of pain and is common to all therapeutic measures. For example, class exercises owe their superiority over individual exercises to suggestion, imitation, and competition, and few would deny the value of group therapy. The mechanism of rest in relieving pain depends on the cause of the pain, but generally it eliminates frictional irritation in joints, tendons, and muscles, and relieves muscle spasm; and in pain due to ischemia, whether of muscle or nerve, it reduces the metabolic requirements of damaged tissue. Conversely, "rest pain," seen in peripheral circulatory failure, may be relieved by modified and graduated activity increasing the collateral circulation.

It is a common observation that pain due to swelling — e. g., in massive edema of the legs in cardiac failure or in nephritis — is always aggravated by coexistent inflammation. It has been suggested in explanation of this that in inflammation histamine or a histamine-like substance is liberated. The chief objection to this is that histamine when injected gives rise to itch but not to pain, and that histamine when ionized relieves certain types of peripheral pain. Further, Schumacher (1943) showed that a skin erythema induced by local irradiation with ultraviolet rays reduced the pain threshold of the treated skin by fifty per cent, whereas the same degree of erythema produced by nicotinic acid left it unaltered. He concluded that the difference was due to the presence or absence of inflammation. This is very confusing when we try to explain the mechanism of pain relief by counter-irritation. To say that counter-irritation operates because spatial summation does not take place with pain as it does with heat and cold, and that it is only possible to feel the greater of two simultaneous painful stimuli, is no doubt true, but it does not explain why moderate counter-irritation, not even reaching the intensity of discomfort, may abolish the primary pain. A prolapsed intervertebral disc gives rise to pain because it induces ischemic neuritis; and, though no physical therapy measure that the author knows of can reduce the prolapse, properly applied heat, combined with rest and traction, often can relieve pain by resolving the inflammation and surrounding edema which accompany the prolapse.

Spa Treatment — Its Relation to Medical Rehabilitation. R. A. Lockwood.

Brit. J. Phys. Med. **14**:255 (Nov.) 1951.

Although there is nothing new or mysterious about the beneficial effects of treatment at a spa, their use should not be forgotten or ignored by those giving physical treatments. The major British Spas are making a serious and useful contribution to general health and to those in need of rehabilitation in particular.

The aims of spa treatment generally may be summarized as follows: (1) Placing the patient in the most favorable environment for treatment and thus counteracting adverse psychological influence; (2) the removal of waste products due to faulty metabolism or infective process through the bowels, kidneys or skin; (3) the acceleration of the interchange between blood and tissue fluids by stimulating the circulation of blood and lymph; (4) improving metabolism so as to secure increased resistance to infection; (5) breaking down fibrous adhesions — dispersing thickenings in the muscles, tendons and joints, and (6) increasing, where possible, range of joint movement and reeducation of muscle power and control.

These aims will be recognized as being eminently suitable for the treatment of the rheumatic group of diseases, but are equally applicable to other conditions such as poliomyelitis, postoperative and orthopedic conditions, and the after-effects of joint, bone and muscle trauma. A wide range of known physical treatments is used at all spas, and after diagnosis a treatment plan should be drawn up having regard to the physical, radiological and pathological findings, and the object in view. It is usual for a patient to be prescribed hydrotherapy and physical therapy treatments on alternate days, together with interspaced recreational, occupational and diversional therapy. It is the type of physical treatment classed as hydrotherapy which is not too well known to physicians and physical therapists, and which, in a large proportion of patients, is responsible for improvement. Quite often patients have received extensive massage, heat and electrotherapy, either as in-patients or out-patients at their local hospital before they are sent for treatment of the spa type. Some of the principal baths or forms of balneotherapy used are: immersion, aerated, douche massage, undercurrent douche, vapor, peat packs and baths, deep pool and therapeutic pool. Packing in towels, sheets and blankets forms an important part of the treatment. It is possible in a short article to deal with only a few of the many types of hydrotherapy used. The spa regimen, or as it must now be called — spa rehabilitation — utilizes all the forces that nature and man can provide. It is the combination of these factors which enables the physical therapist to achieve, objectively and subjectively, so much more than physical therapy alone.

Rehabilitation Unit. H. Worley Kendell.

Mod. Hosp. **78**:67 (Mar.) 1952.

Since the ideal of comprehensive medical care cannot be realized without physical medicine and rehabilitation, the extent to which these restorative techniques are offered as an essential part of the community health program is more or less a measure of the extent to which the ideal has been realized. The picture here is not entirely encouraging, and it now seems that the best hope for improvement lies with the general hospital. While the purpose of this paper is to discuss certain practical aspects of organizing and administering a department of physical medicine and rehabilitation in a general hospital, a prior consideration is a clear understanding of the function and scope of this relatively new specialty. The organization of a department of physical medicine and rehabilitation in a community hospital must begin with the community. Intelligent planning requires a thorough knowledge of local needs and resources, and utilization of them should stress integration. If planning is realistic as well as imaginative, many resources and much equipment not located in the hospital itself may be used in various stages of the rehabilitation process, with a net result fully as satisfactory as those achieved with vastly greater outlay in large cities. For example, tools and machinery of the local vocational school may be scheduled for use under a cooperative plan; or certain exercising facilities in the high school may be utilized; or graduated work plans with the cooperation of industrial plants may be used.

Contents—Dec. 1952

Volume XXXIII No. 12

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ORIGINAL ARTICLES

Two Important Statistical Devices. Frederic T. Jung, M.D. 711
Discussed by Dr. E. M. Smith.

Rehabilitation Following Ruptured Intervertebral Disc Surgery. John H. Aldes, M.D., and Frances Koerner, B.A., R.P.T. 721
Discussed by Dr. Shelby G. Gamble.

Continuous Oxygen-Aerosol for the Tracheotomized Respirator Patient. Robert Denton, 1st Lt., USAF (MC), and Joseph N. Schaeffer, Lt. Col., USAF (MC) 727

The Tilted Crutch Handpiece. Herbert W. Park, M.D.; Eleanore W. Malone, R.P.T., and Ruth Steglich, O.T.R. 731

•

Medical News 734

•

Editorial 735

•

Book Reviews 740

•

Physical Medicine Abstracts 746

•

INDEX

Volume XXXIII, January-December, 1952, Inclusive.... 750

•

EDITOR OF THE MONTH

WALTER M. SOLOMON, M.D.

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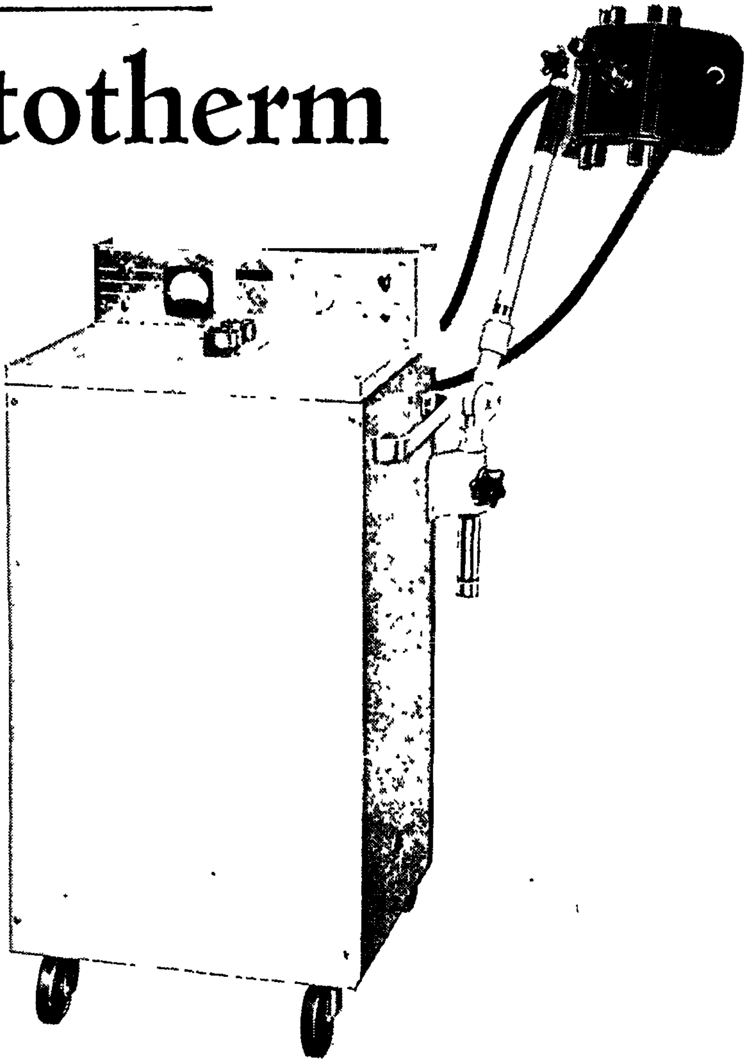

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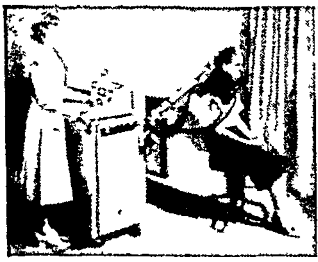

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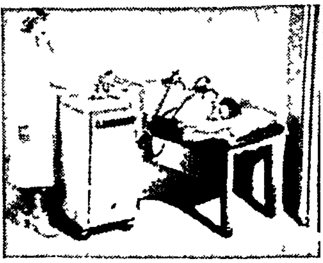

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TWO IMPORTANT STATISTICAL DEVICES *

FREDERIC T. JUNG, M.D.

Council on Physical Medicine and Rehabilitation
American Medical Association

CHICAGO

An attempt to present a mathematical subject to a non-mathematical group is inevitably between two fires: readers familiar with the subject may complain of superficiality while others may complain of obscurantism, affectation, or pedantry. There is, however, a great need for a better appreciation of the help frequently offered by statistics in medical research.

In particular, the two ideas I have been asked to explain in the present paper urgently deserve attention. They happen to be relatively simple, but are also fundamental and practical. Year after year sees new therapeutic procedures introduced in ways that mislead hosts of people as to the benefits obtained and expected. Often the therapy is based on a newly introduced diagnostic procedure that likewise has been introduced in a way that misleads people as to its reliability and significance. One of the less painful consequences is the rejection of inconclusive papers by the editors of medical journals. Another is the nonacceptance of drugs and apparatus for lack of evidence that they are effective and safe. More important is the waste of the research worker's effort, time, and money. The worst, of course, is the fear aroused in patients by mistaken positive diagnoses, the harm done by the delays resulting from mistaken negative diagnoses, and the damage, which need not be further suggested, done by ill-advised treatment.

It would not be difficult to find illustrations of these facts in recent medical history, but an especially good example occurred in the 1790's when a famous and influential physician in Philadelphia introduced a drastic new treatment for yellow fever.[1] Although the sufferers from this disease were generally dehydrated from incessant vomiting and anemic from gastrointestinal hemorrhages, this physician advocated bleeding, emetics, and purgatives, and actually gave them. In spite of the size of his practice, in which he must have treated innumerable patients, he continued to maintain that his treatment was justified both as to theoretical basis and actual results. Incredulous colleagues were silenced, and his one outspoken critic was sued at law, ruined financially, and driven out of Philadelphia. In those days few people thought of statistics, of contratests, and of probability, and mistakes were perhaps more excusable. Today such mistakes can be made only if one ignores what is known about tests for the reliability of diagnostic methods and for the significance of therapeutic results.

This paper is devoted simply to two important statistical ideas or tricks which are very likely to be useful in research in physical medicine. These are: (a) The *TEST-RETEST* (rank-difference) method, useful in appraising results of new *diagnostic* procedures. (b) The *FOURFOLD TABLE,* useful in appraising results of new *therapeutic* procedures.

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* Read at the meeting of the American Congress of Physical Medicine, Denver, Colorado, September 5, 1951.

[1] Editorial: Are Statistics Necessary? J. A. M. A. 143:1260 (Aug. 5) 1950.
Shryock, R. H.: The Development of Modern Medicine: An Interpretation of the Social and Scientific Factors Involved, Philadelphia, University of Pennsylvania Press, 1936.

Test-Retest Procedure

The test-retest procedure is based on the self-evident truth that diagnostic tests should be done in duplicate whenever possible, especially when they are in process of development by their discoverer, but also when they are being adopted in a laboratory where they are new. Some laboratories have been content to see whether a new quantitative method gives the same average reading for a group of subjects as does an older method. This is a very helpless policy, and if the averages differ it does not tell which method is the better. Other laboratories see to what extent *individual* readings by the new method correspond with individual readings by an older method. If the older method is sufficiently direct and reliable to serve as a standard, then such comparison is well justified, and it can lead to the calculation of a quantity called the *index of validity.*

Now there may not be an older method. In that case the test-retest procedure becomes especially valuable. It leads to the calculation of a quantity called the *index of reliability,* and consists essentially of running duplicates as promptly as possible after the first test. The results of the first and second tests are then recorded in parallel columns, as in Table 1.

TABLE 1. — *Raw Data from a Test for Capillary Fragility.*

Subject's Initial	First Score	Second Score
Ra	8	10
J	23	54
S	1	32
W	4	5
B	4	13
D	6	12
Fr	16	8
A	12	12
Fi	11	17
M	11	14
T	8	2
Ro	2	6
	106	185

Table 1, shows the results of a test for capillary fragility. At the time when these data were obtained, the test was being tried out in the hope that it might be useful in a certain vitamin study. Twelve healthy subjects were tested with an apparatus that applied measured suction for measured lengths of time to the volar surface of the forearm. The resulting petechiae were counted. The day's results were scored by an arbitrary method that took into account several applications of the suction, and each subject was retested a week later.

The first thing noticed is that retesting after a week's time gave scores about 75 per cent higher than before, even though the diet had remained the same. This discrepancy alone would have cast some doubt upon the usefulness of such a test, but would not actually have condemned it since many things, such as a change of weather, might have had some genuine effect on the group as a whole. What brought out most clearly the unreliable nature of the test was the calculation of the reliability index as shown in Table 2

The calculation consists in substituting ranks for the original scores. When two subjects tie for a given place they are given the same average rank (e. g., W and B tied for 3rd and 4th place, and both receive 3½). One can now see to what extent there has been an interchanging of places in the

TABLE 2. — *Ranked Data from the Capillary Fragility Test.*

Subject's Initial	Rank in 1st Test	Rank in Retest	Difference = D	D^2
Ra	6½	5	+1.5	2.25
J	12	12	0	0.00
S	1	11	—10	100.00
W	3½	2	+1.5	2.25
B	3½	8	—4.5	20.25
D	5	6½	—1.5	2.25
Fr	11	4	+7	49.00
A	10	6½	+3.5	12.25
Fi	8½	10	—1.5	2.25
M	8½	9	—0.5	0.25
T	6½	1	+5.5	32.25
Ro	2	3	—1	1.00
				224.00

Sum of squares $= \Sigma(D^2) = 224$.

table by forming the column of differences D.

If we square the differences and add, we get the sum of the squares of the differences.

This sum is substituted in a very simple formula ascribed to Spearman:

$$R = 1 - \frac{6\,\Sigma\,(D^2)}{n\,(n^2 - 1)}$$

Where n = number of pairs of measurements.
Here $\Sigma\,(D^2) = 224$, $n = 12$ and $n^2 - 1 = 144 - 1 = 143$.

$$\text{Then } R = 1 - \frac{6 \times 224}{10 \times 143} = 1 - 0.783 = +0.22.$$

This formula is so constituted that the answer R always comes out between —1.00 and +1.00. Negative values for R are exceptional, and can occur only by accident if very poor tests are done on small groups of subjects. In general, +1.00 means perfectly consistent results, +0.90 means a gratifying amount of consistency in a new test, +0.50 means an unacceptably poor test in need of further refinement, and 0.00 means that the results are chaotic. In the present instance, R came out +0.22. A test with so low a reliability index can cause nothing but trouble unless it is capable of improvement, for instance by careful standardization of conditions and the development of elaborate systems of scoring.[2]

When the results of a retest are chaotic, an interesting phenomenon can be observed. The people who did most poorly at the first testing are almost certain to be found near the average on the retest, just as the people who get aces the first time some playing cards are dealt are unlikely to get all the aces on a re-deal. Moreover, anything done in the interval between test and retest may be credited with the supposed improvement of the people who did most poorly on the test. This prenomenon, long recognized as *regression toward the mean* or *centripetal drift*,[3] has been a source of fallacy in much clinical research. That it may have been responsible for confusion in the early work on rutin and hesperidin is suggested by the strange experiences of one investigator, who found that his subjects improved after taking a remedy that had no relation to their assumed deficiencies and that they improved, moreover, too promptly for the remedy to have exerted its supposed action.

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[2] Bovard, J. F., and F. W. Cozens: Tests and Measurements in Physical Education. Philadelphia, W. B. Saunders Co., 1911.

[3] Jung, F. T.: Centripetal Drift: A Fallacy in the Evaluation of Therapeutic Results. Science. 87:461, 1938.

To understand more of the workings of the test-retest procedure and the rank-difference calculation, we may compare the unreliable clinical test just discussed with a very reliable one, namely, the result of weighing the patient. A patient's body weight is a quantitative, objective and very informative datum; moreover, it is one of the most reliable data available. To appreciate this we start with an imaginary case.

We assume that ten boys were weighed in turn first by one investigator and, a few moments later, by a second investigator in a different room. We assume that the first investigator had a balance reading in the avoirdupois system accurately to the nearest quarter of a pound. We finally assume that the second investigator, who did the retesting, was handicapped by a balance that not only had a zero-error of one pound (i. e., read "one pound" when there was nobody standing on it and it ought to be reading zero) but also could be read only to the nearest pound. When the results are calculated by the rank-difference method, it is seen that R comes out very near +1.00. There have been only trivial effects on the relative standing of the 10 boys, and despite the handicap of a poor balance, the weighings turn out to constitute a far more reliable source of data (have a higher index of reliability) than did the test for capillary fragility.

TABLE 3. — *Example of Good Test-Retest Results.*

(*Results of independent weighing of ten boys by two examiners with different balances.*)

Boy	First Weight (in Pounds and Quarters)	Second Weight (to Nearest Pound)
EK	85-3	87
FS	86-2	88
GW	91-3	93
D	71-3	73
EF	82-1	83
CG	75-1	76
LH	85-2	86←
C	76-3	78
CC	85-1	86←
WC	88-1	89

Calculation:	Subject	Rank		Difference = D	Square = D^2
		Test	Retest		
	EK	7	7	0	......
	FS	8	8	0	......
	GW	10	10	0	......
	GD	1	1	0	......
	EF	4	4	0	......
	CG	2	2	0	......
	LH	6	5½	0.5	0.25
	MC	3	3	0	......
	CC	5	5½	0.5	0.25
	WC	9	9	0	——

$$\Sigma (D^2) = 0.50$$

$$R = 1 - \frac{6 \times 0.50}{10 \times 99} = 1 - 0.003 = +0.997.$$

Since +0.997 is so near +1.000, this means that body-weights have a high "index of reliability."

To see how useful a datum a person's weight really is, we now take some actual figures from a study of adolescent boys. Table 4 gives the results of weighing ten boys on a given day and then re-weighing them six months later.

TABLE 4. — *Retesting After Lapse of Six Months.*

Subject	Weight		Rank	
	1935	1936	Test	Retest
EK	85-3	91-0	7	6
FS*	86-2	74-0	8	1*
GW	91-3	98-0	10	10
GD	71-3	77-2	1	2
EF	81-1	83-0	4	4
CG	75-1	79-0	2	3
LH	85-2	91-3	6	7
MC	76-3	83-1	3	5
CC	85-1	92-3	5	8
WC	88-1	96-2	9	9

Because the number of subjects is small, the loss of weight by FS* greatly affects the result, so that R = +0.63. This does not mean that the weights are unreliable, but that body weight is not a fixed characteristic.

In this table one sees the rapid gains made by most of the boys, as is expected in adolescence. One of the boys, however, has lost weight, presumably because of sickness. This not only affected his own rank markedly, but also shifted six of the others. In this instance, the result is that R (remembering the interval of 6 months) fell to +0.63. This low value is to be taken to mean *not* that the weighings were unreliable *but* that body weight is a somewhat variable thing. Curiously, when the boys were reweighed *sixteen* months after the first test, subject FS had recuperated and had become the heaviest of the group. R calculated over this interval of 16 months is found to be +0.86.

TABLE 5. — *Retesting After Lapse of Sixteen Months.*

Subject	Weight		Rank	
	1935 Oct.	1937 Feb.	Test	Retest
EK	85-3	102-2	7	7½
FS*	86-2	133-0	8	10*
GW	91-3	112-0	10	9
GD	71-3	93-0	1	4
EF	81-1	92-1	4	3
CG	75-1	90-2	2	2
LH	85-2	96-2	6	5
MC	76-3	84-2	3	1
CC	85-1	100-3	5	6
WC	88-1	102-2	9	7½

Subject FS* more than regained his rank by a marked growth-spurt. R = +0.86 despite the lapse of 16 months.

Table 5 shows that body weight is a fairly characteristic thing for a given individual despite temporary fluctuations.

An even more reliable measurement is that of height. Even when measurements of height are repeated after six months in fast-growing boys, the boys are likely to come out in about the same order of rank (Table 6). These are actual data from a study of adolescence.

TABLE 6. — *Retesting After Lapse of Six Months.*

Subject	Height*		Rank	
	1935 Oct.	1936 Apr.	Test	Retest
EK	57-4	58-2	5	5
FS	54-4	55-6	2	2
GW	59-5	60-5	8	8
GD	53-0	53-2	1	1
EF	58-5	59-2	6	6
CG	55-2	56-1	3	3
LH	60-2	60-6	10	9
MC	57-2	58-1	4	4
CC	58-6	58-7	7	7
WC	59-7	61-5	9	10

*Height in inches and eighths.
R = +0.99 despite lapse of 6 months.

The calculations are complicated by the unfortunate use of feet and inches, and much labor would have been saved by adhering to the metric system from the beginning. However, the boys were measured again sixteen months after the initial observations, and R was found still to lie very close to +1.00, namely, +0.98.

TABLE 7. — *Retesting After Lapse of Sixteen Months.*

Subject	Height		Rank	
	1935 Oct.	1937 Feb.	Test	Retest
EK	57-4	60-5	5	5½
FS	54-4	58-2	2	2
GW	59-5	62-4	8	8
GD	53-0	57-0	1	1
EF	58-5	60-5	6	5½
CG	55-2	58-4	3	3
LH	60-2	62-2	10	9
MC	57-2	59-6	4	4
CC	58-6	61-5	7	7
WC	59-7	63-4	9	10

Despite the lapse of 16 months, R = +0.98 in adolescent boys.

Evidently the retesting procedure, combined with Spearman's rank-difference method of calculating the results, is useful for many things. It tells how consistent a test is with itself; if there are several possible ways of scoring the test, one can choose the way that gives the highest R; it enables one to distinguish the stable characteristics of the human body from those that fluctuate. It also has other uses that cannot be discussed now. They become evident to one who works with it. For that reason the test-retest procedure is earnestly recommended as an important statistical device.

The Fourfold Table

The other device to be described here is the fourfold table, also called the 2 by 2 table. It is the simplest case of a more general arrangement known to statisticians as the *m* by *n* table. It is surprisingly easy to work with after a few examples have been carried through, and once it has been mastered it gives a quick insight into problems that seem at first quite complex.

The illustration chosen here is from a recent paper in which the author reports some experiences in a summer camp for boys. He wished to see whether a certain new antihistaminic drug was effective in clearing up the common cold. He wisely instituted controls, and the experiment consisted in comparing the effects of the new drug with a placebo that looked and tasted like the drug. He gives his original data in the following form:

TABLE 8. — *Raw Data from Study of New Antihistaminic Drug.*

Subject	Antihistaminic	Placebo
A	Improved	Cured
B	Worse	Improved
C	No change	Worse
D	Improved	Worse
E	Cured	Improved
F	Improved	Improved
G	Cured	No change
H	Cured	Improved
I	Improved	Cured
J	No change	Worse
K	Improved	Improved
L	Improved	Cured

Each patient was treated for colds occurring at least 10 days apart, once with the antihistaminic drug, once with the placebo.

Upon inspection of this table, and after some cogitation, one gathers from these data that the drug was no better than the placebo, and that is what the investigator rightly concluded.

However, these data can be put into a compact form that enables one to tell much more quickly whether the results were positive or not and enables one, moreover, to compute probabilities in the event of doubt.

TABLE 9. — *Same Therapeutic Data Arranged as Fourfold Table.*

	Unchanged, Improved or Cured	Worse	Totals
New antihistaminic	11	1	12
Placebo	9	3	12
Totals	20	4	24

All the figures in this table refer to number of trials. It says, for instance, that 1 patient who tried the antihistaminic drug felt worse while 3 who tried the placebo said they felt worse. The figures in the four "cells," the subtotals, and the grand total of a fourfold table are always numbers of people, numbers of animals, numbers of trials, in short, they are always what the statistician calls "frequencies," telling how often a thing has happened or how often something has been done. After some experience with fourfold tables one can simply look at these frequencies and tell whether there is much difference between test-subjects and controls, but the statistician is now able to go on to compute a quantity called chi-square by a simple formula.

Computation of Probability That Favorable Results Might Be Due to Chance.

Code:	a	b	R	Figures:	11	1	12
	c	d	S		9	3	12
	U	V	T		20	4	24

$$\text{Chi-square} = \frac{(ad - bc)^2 \times T}{R \times S \times U \times V} = \frac{(11 \times 3 - 1 \times 9)^2 \times 24}{12 \times 12 \times 20 \times 4}$$

$$\frac{(24)^2 \times 24}{24 \times 24 \times 20} = 1.2$$

For the value 1.2, tables of chi-square give $p = 0.27$ (27 chances in 100) as the probability that the above favorable effect might be accidental. It is therefore not convincing.

In interpreting a fourfold table, it is customary to focus attention upon any one figure actually occupying one of the four "cells" of the table and to compare it with the theoretical figure that would have been most likely to occur there if pure chance had determined the outcome. The theoretical figure is easily determined by multiplying the corresponding two subtotals and dividing by the grand total. Thus, to the actual frequency 3 in the present table corresponds a theoretical frequency obtained from the two subtotals 12 and 4 and the grand total 24 thus: $12 \times 4/24 = 2$. The disparity between the theoretical figure 2 and the actual figure 3 is obviously trivial, and the likelihood that so small a difference between actual and theoretical could have arisen simply by chance is great.

In any but the simplest cases, however, this likelihood has to be determined. This is done by calculating chi-square and then using tables of "chi-square for one degree of freedom" to determine the probability. (A good table is that of Pearl.[4]) If chi-square comes out above 3.8 the statistician concludes that the difference between test-subjects and controls would have happened by accident less than five times in 100. He may be satisfied with this. If one wishes to be more certain, he may ask that the chances be less than 1 in 100; in that case chi-square must exceed 6.6. In the present case chi-square comes out only 1.2, and it is found from tables of chi-square that the difference between test-subjects and controls could have happened by accident 27 times in 100. The statistician would therefore agree with the author that the new drug was no better than the placebo.

Sometimes the same data can be set up as a fourfold table in more ways than one. There is no law against examining your figures from every imaginable viewpoint. The figures just given for the antihistamine study could also be set up thus:

	Improved or Cured	Unchanged or Worse	Totals
New antihistaminic	9	3	12
Placebo	8	4	12
Totals	17	7	24

Another possibility is this:

	Cured	Improved, Unchanged or Worse	Totals
New antihistaminic	3	9	12
Placebo	3	9	12
Totals	6	18	24

This last formulation makes the lack of differences between placebo and antihistaminic in the present experiment especially clear.

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[4] Pearl, Raymond: Introduction to Medical Biometry and Statistics. Philadelphia, W. B. Saunders Co., 1940, pp. 480-488. Mainland, Donald. Elementary Medical Statistics. Philadelphia, W. B. Saunders Co., 1952, pp. 122 and 318.

Before dropping the subject of the fourfold table it should be noted that if one tries to put the results of an investigation into this form one immediately discovers whether there have been proper "controls." The idea of "controls" is one of the most fundamental in the philosophy of modern biological experimentation, and has immense practical consequences. Thirty if they involve human subjects, the critic's first question was "Where are if they involved human subjects, the critic's first question was "Where are your controls?"

Since that time there has been a regrettable weakening on this point. One sees laboratory manuals in which the directions fail to specify the necessary "controls"; one sees books in which the word is used in ways that not only mislead the student but make one suspect that the author neither understood the idea nor appreciated its importance. There is a semantic reason for this. The word "control" was well established in the English language with other meanings before it was adopted into the scientific vocabulary in its present sense. To most people it still means to govern, to regulate, to rule, or to supervise, and a "controlled experiment" might well be one that is closely watched by some authority. But in definance of the semantic rule that every term should have but one meaning and that one meaning requires but one term, the word "control," when used in biological experimentation, was given its present arbitrary and altogether unexpectable meaning. The manufacturer, tradesman, technician, salesman, even the philosopher and the science reporter may use it without thinking, because it sounds familiar; there is nothing in it to warn the user that it carries a special meaning to the biologist. To add to the confusion, the German vocabulary contains a word "Kontrollversuch" in which "Kontrolle" means "control" in the old, general sense, not the new scientific sense. Fortunately the German also has a very illuminating word "Gegenversuch" which does mean a scientifically controlled experiment. The French language has the equally good word "contre-essai." These German and French words have the immense advantage over the English "control" in that they are almost self-explanatory and certainly are never used in any other sense. The English "contratest" translates them quite exactly and is much better than the word "control." There is every reason why "contratest' should be used henceforward to replace the ambiguous and utterly confusing "control."

About the importance of contratesting medical investigations little more needs to be said at this point. A recent article by Ross[5] showed that 45 out of 100 published medical articles betrayed a lack of the contratests needed to make them convincing. He also gave instances to show how contratests can be set up and how significant they can be in determining the value of the work. A wider appreciation of the fourfold table will help to make sure that the necessary contratests are used in medical research.

Summary

New diagnostic tests should themselves be tested for validity or reliability by recognized statistical methods, such as the test-retest method.

New methods of treatment should be tested and contratested. The contratest group may be untreated, or may receive a placebo, or may preferably receive a previously accepted conventional treatment. The investigation should involve a comparison between test and contratest groups. The probability that observed differences are significant can often be calculated easily after the results are set up as a fourfold table.

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[5] Ross, Otho B., Jr.: Use of Controls in Medical Research. J. A. M. A. 145:72 (Jan. 13) 1951.

Discussion

E. M. Smith, Col., (MC) U.S.A. (Washington, D. C.) : Dr. Jung has warened us about difficulties of talking on mathematics to a non-mathematical audience. His presentation certainly brings to my mind several mistakes in the therapeutic field that could have been avoided if the procedures advocated by Dr. Jung had been followed. For example, around twenty (20) years ago, intravenous mercurochrome was considered to be efficacious yet its therapeutic value was purely empirical.

Mucin only recently had strong advocates for treatment of peptic ulcer. It, too, has become less popular. The next item I can recall I mention for provocative reasons and that is ion transfer. I know of no study being made with measurements of the affect of a drug by iontophoresis that has been associated with control study. Nor have I seen any studies on iontophoresis disclosing the drug assimilated by this therapeutic procedure together with the amount of drug excreted in urine during treatments.

Another example is the problem of basal metabolic rates which has been under question for some time. Today the radioactive iodine has its advocates. I am told it is a very meticulous and sensitive test. Things are accepted, however, in certain eras or times which are later proved erroneous. Not many years ago albumin in urine was diagnostic of Nephritis. Many cases of Pneumonia in those days would manifest albumin in urine, and their death certificate would read "Nephritis" rather than "Lobar Pneumonia." That I consider an error of the times. Dr. Jung has advocated that the term "control" as not being a good scientific term and he believes in the word "Contra - test" and recommends it for adoption.

Thanks are due to Dr. Jung for covering a most difficult subject in simple language and in short time.

RESOLUTION APPROVED

The report of the Council on Medical Education and Hospitals of the American Medical Association was approved by the Advisory Board of Medical Specialties at its business meeting on February 10, 1952. Included in this report was the following Resolution:

"Whereas, An emergency medical call service is of proven value both as a community public service and as a means of good public relations between a physician and his community; and

'Whereas, Participation in such a service is not onerous if many physicians cooperate; and

"Whereas, Every County Medical Society has been asked to operate such an emergency service; therefore be it

"Resolved, That every doctor below the age of 35 years, regardless of his type of practice, be urged to participate in his community's call plans; and be it further

"Resolved, That all national specialty boards be requested by the Secretary of the American Medical Association to facilitate such general participation by assuring their members and potential members that they may participate in such a community activity without jeopardy to specialty ratings.

"Amendment —

"Resolved, That all national specialty boards be requested by the American Medical Association to facilitate such general participation by assuring their members and potential members that they may participate in such a community activity without jeopardy to specialty ratings."

REHABILITATION FOLLOWING RUPTURED INTERVERTEBRAL DISC SURGERY*

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Much has been published on the pathology, symptomatology, diagnosis, and operative techniques for herniated intervertebral discs but on the subject of pre- and postoperative treatment, little has been written.[1-2-3]

It is our problem as specialists in rehabilitation to outline and supervise not only the preoperative treatment, but also the postoperative regime which rehabilitates the individual back to a normal and useful life.

This paper is concerned with the patients who demonstrate chronic symptoms of herniated intervertebral discs.[4] In evaluating series of cases of both operative and non-operative treatment for those patients, we have found that success in returning the patient to his normal daily activity was due primarily to emphasizing the treatment of the residuals such as spasm, atrophy, and contractures of not only the lower back muscle groups, but also of the entire affected lower extremity.

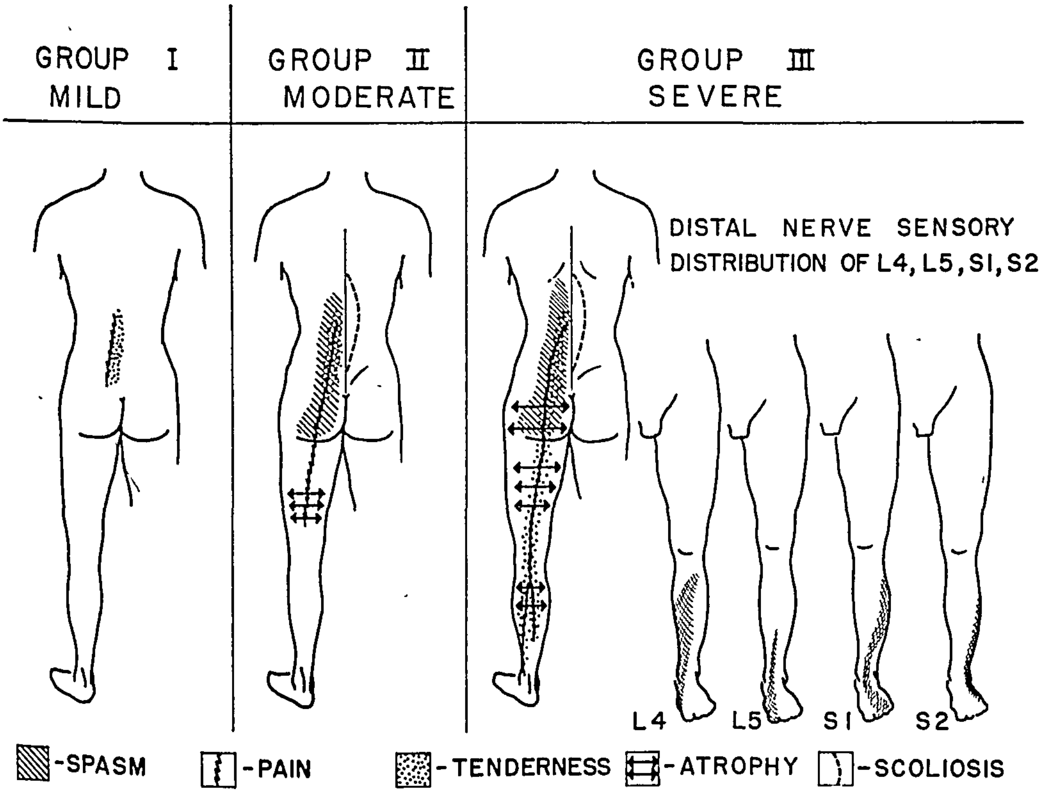

Fig. 1. — Low Back Residual Syndrome Classification.

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* Presented at the Twenty-Ninth Annual Scientific and Clinical Session of the American Congress of Physical Medicine, Denver, Colorado, September 7, 1951.

† Department of Rehabilitation and Physical Medicine, Cedars of Lebanon Hospital, Los Angeles, California.

1. Barr, Joseph S.: The Relationship of the Intervertebral Disc to Back Strain and Peripheral Pain (Sciatica), Surgery 4:1 (July) 1938.

2. Barr, Joseph S., and Mixter, William Jason: Posterior Protrusion of the Lumbar Intervertebral Discs, J. Bone & Joint Surg. 28:444 (April) 1941.

3. Greenwood, James, Jr.: The Protruded Intervertebral Disc Diagnosis, Treatment and Results, Arizona Med. 4:33 (May) 1947.

4. Raney, R. Beverly: Conditions Involving the Lower Part of Back, Arch. Surg. 55:87 (July) 1947.

In outlining the program for the rehabilitation of these individuals, we think it is important to classify the residuals into three groups: mild, moderate, and severe. This classification is based upon the duration and severity of the herniated disc (fig. 1).

Classification.

Group	Pathology	Symptoms and Signs
I. Mild	Small protrusion which does not cause nerve root pressure.	1. Transient or intermittent low back pain. 2. Muscle spasm. 3. Mild tenderness on palpation in the involved area.
II. Moderate	Protrusion causing a slight pressure on nerve root.	1. Low back pain. 2. Sciatic pain radiating to gluteal and posterior thigh on involved side. 3. Muscle spasm of lumbar, sacral, and gluteal areas. 4. Atrophy of lower third of thigh. 5. Decreased lumbar curve. 6. Scoliosis opposite to the affected side. 7. Moderate tenderness on palpation on involved side. 8. Mild sensory changes in affected thigh.
III. Severe	Marked pressure on one or more nerve roots.	1. Severe low back pain. 2. Intractable sciatic pain. 3. Muscle spasm of lumbar, sacral and gluteal areas. 4. Atrophy of the affected gluteal, thigh, and leg muscles. 5. Diminished lumbar curve. 6. Scoliosis away from affected side. 7. Marked tenderness of low back and extremity. 8. Neurological changes including hypesthesia of the leg and foot depending on localization of the lesion. 9. Absence of Achille's reflex. 10. Dorsi flexion weakness.

The individual's distress is due less to the basic etiological factor, which is the protruding disc, than to what we call the "low back residual syndrome." The patient has a pain syndrome which is set up in proportion to the various degrees of pressure upon the nerve root or roots. Unconsciously, he will protect himself from pain, producing a spasm of the erector spinae group which splints his back and thus diminishes the lumbar curve. As the severity of the spasm increases, a lumbar "functional scoliosis" is produced. With spasm and additional pressure upon the peripheral nerves, we find neurological changes occurring.[5-6-7]

Following radiation of pain, whether to the gluteal area, thigh, leg, or foot, the normal reaction of the patient is not to use that extremity. With the disuse of the extremity we get the phenomenon of muscular atrophy of the lower third of the thigh and calf and, as a consequence, generalized weakness with decreased muscle tone of the affected muscle groups.[8]

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[5] Motley, Lyle: Neurogenic Pain Simulating Visceral Disease, Am. J. Med. 4:539 (April) 1948.

[6] Hoen, Thomas I.; Anderson, Robert K., and Clare, Frank B.: Surgical Clinics of North America, Philadelphia and London, W. B. Saunders Co., 1948, pp. 456-466.

[7] Bucy, Paul C.; Heimburger, Robert F., and Oberhill, Harold R.: Compression of the Cervical Spine Cord by Herniated Intervertebral Discs, J. Neurosurg. 5:471 (Sept.) 1948.

[8] Bradford, F. Keith, and Spurling, G. Glenn: The Intervertebral Disc, Illinois, Charles C. Thomas, 1945.

With the aforementioned in mind, our postoperative rehabilitation is prescribed to treat the "low back residual syndrome." Failure to begin presurgical muscular therapy may mean the difference between a short or a prolonged convalescence. This is especially true of the moderate or severe groups where diminished muscle tone, atrophy, contractures, and weakness of the back and lower extremity prior to surgery will greatly affect the success of our operative procedures.

In the mild group with intermittent attacks of low back disability due to a mild discogenic disease, a sound, conservative, and noninterrupted program rather than surgery, will increase the percentage of successful cases.

For the relief of muscle tenderness and spasm, short wave diathermy. infra-red, and hot packs are beneficial. Following this a moderate type of massage, including effleurage and light petrissage, will aid in eliminating the waste products of muscle metabolism and increase the blood circulation.

Choice of sedation for diminishing the pain and promoting relaxation is important prior to the therapy. The therapy should be administered twice a day.

In the case of low back immobilization for this group, some form of support such as a lumbo-sacral webbed corset or a two-way stretch "pant bracer" rather than taping is advisable (fig. 2). By using these in acute and sub-acute stages, the injured area is protected from further possible strain, and skin irritation is avoided.

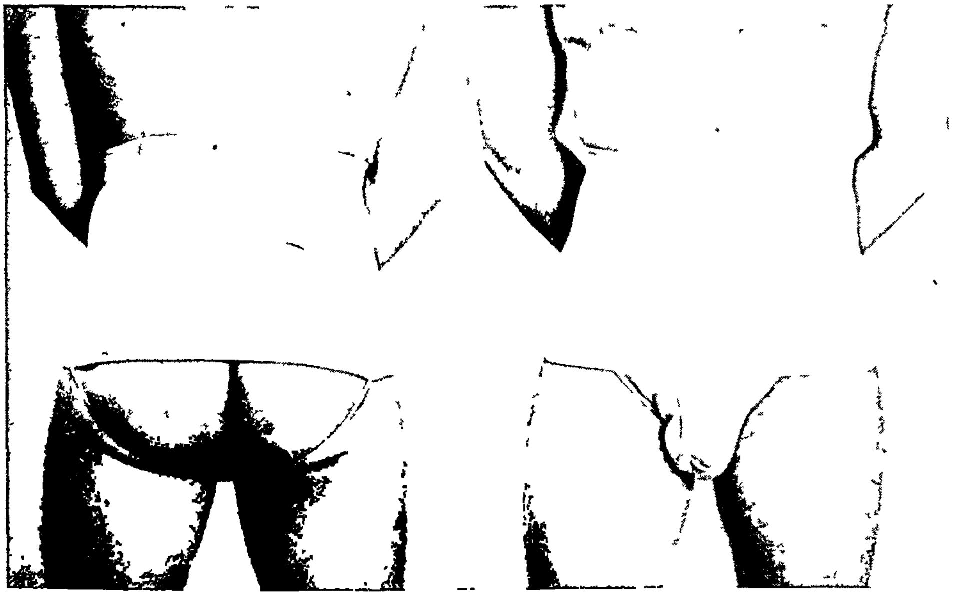

Fig 2 — Pant Bracer The bracer is a wide band supporter made of elastic webbing which must fit snuggly to immobilize the pelvis, lumbar and lower dorsal areas, fitting over the inguinal area This bracer may be worn by a male or a female

As the condition subsides, the objective treatment is that of increasing the tone and strength of the muscles of the affected areas by therapeutic exercises, but at the same time not restricting the therapy to the affected area alone but including the entire body.

The four objectives are: (1) To correct faulty posture and abnormal body mechanics. (2) To maintain normal curves of the spine. (3) To increase muscle tone of the body. (4) To maintain mobility of the spine.

There are many exercises with the above therapeutic aims in mind. The patient should be taught correct posture and should practice sitting and standing before a mirror. The "three-way stretch routine" and "knee to chest" exercises should be performed several times daily to strengthen the erector spinae muscles, gluteals, abdominals, hamstrings, quadriceps, dorsi and plantar flexors of the foot (figs. 3, 4).

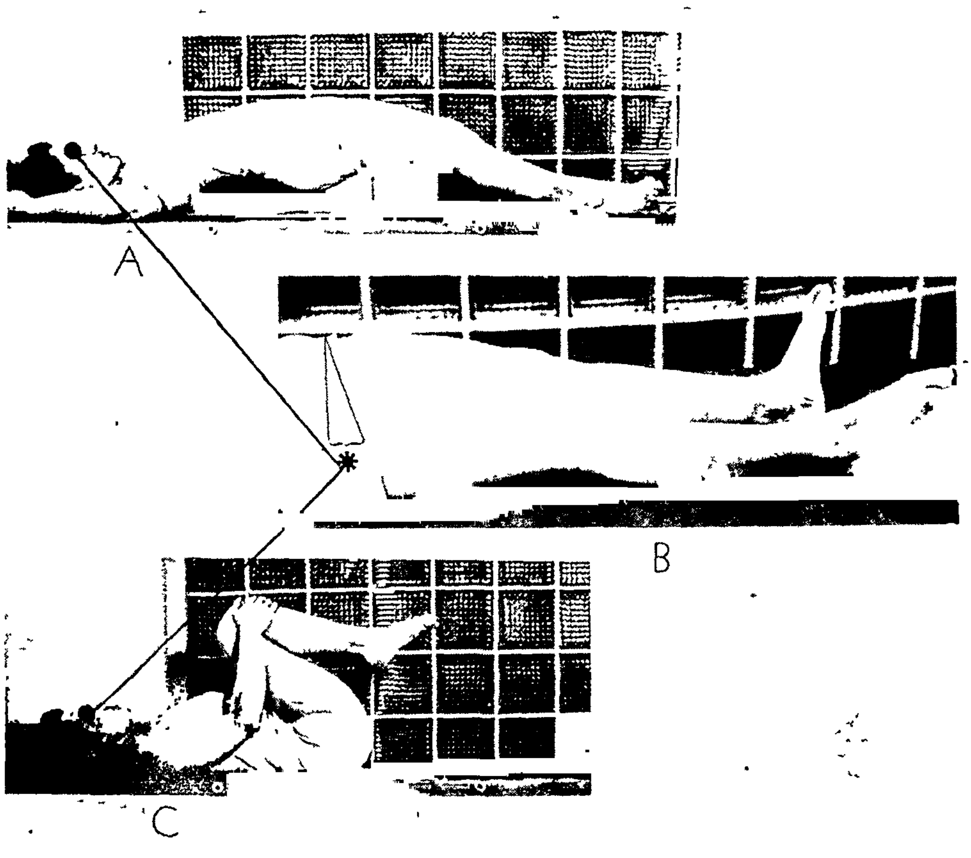

Fig. 3. — Three-Way Stretch. A. Hyperextension of back to strengthen the erector spinae groups, gluteals, hamstrings, and gastrocnemius muscles B. Leg shortening in which quadratus lumborum, lateral abdominals are strengthened on the same side and stretched on the opposite side. C. Both knees to chest to stretch tight lower back muscles and gluteals.

In the moderate and severe groups we are confronted with an involved lower extremity. In addition to the therapy outlined for the mild group, emphasis should be placed upon the reconditioning of the weakened and atrophied muscles of the leg.[9] It is important that in the presurgical procedure, even though the underlying pathology has not been removed, the muscle tone of the affected regions be maintained. If an individual cannot actively contract or relax the weakened muscles prior to surgery, electrical stimulation will prove to be an aid in muscle reeducation. Progressive resistance exercises at this time for the atrophied thigh and calf are of therapeutic value. It is advantageous to instruct the patient in the static exercises he will do for his back, pelvis, and abdomen immediately following surgery.

The following postoperative regime has been successful in our series: The patient lies supine on a hard bed.[10] Seventy-two hours following surgery, static exercises are given for abdominal, gluteal, quadriceps, and hamstring muscles. The patient actively contracts and relaxes these muscle groups without joint motion while lying supine in bed. Instructions for breathing exercises are given not only to avoid chest complications but to improve intercostal and diaphragm muscle tone. With patients who continue to show muscle weakness of the leg, or those in whom there is a weakness as a result of surgery, electrical stimulation is continued. A posterior splint for the leg and foot is important for marked muscle weakness to prevent any deformity. Frequently turning from supine to prone position is not only important to prevent chest and abdominal visceral stasis, but also to restore general body muscle tone.

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[9] Martin, John: The Diagnosis and Treatment of Herniation of the Intervertebral Disc, Arizona Med. 4:29 (May) 1947.

[10] Falconer, Murray A.; McGeorge, Murray, and Begg, A. Charles Surgery of Lumbar Intervertebral Disc Protrusion, Brit. J. Surg. 35:223 (Jan.) 1948.

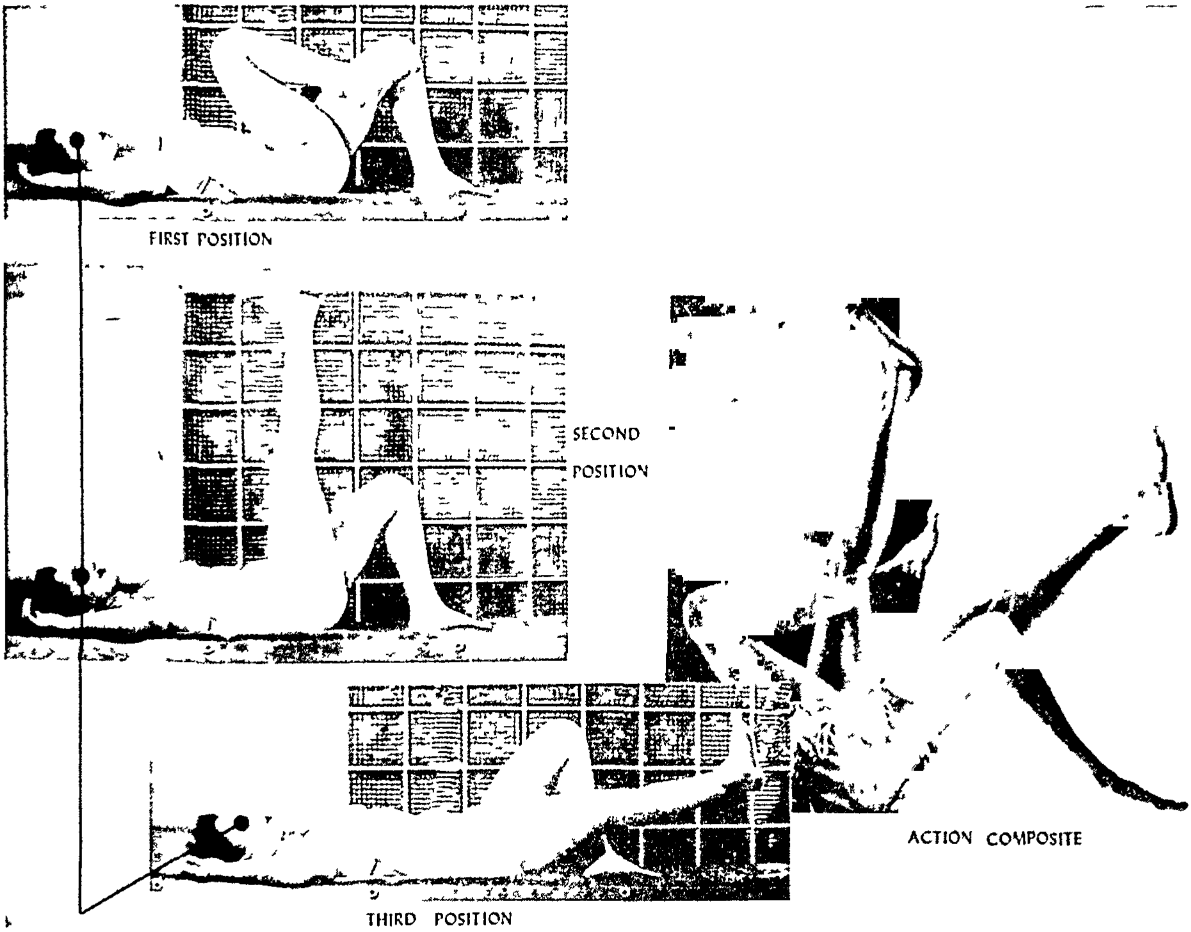

Fig. 1 — Knee to Chest. First position to strengthen abdominals and stretch low back extensors. Second position to stretch hamstrings and strengthen quadriceps. Third position to strengthen abdominals.

At the end of eight days, following removal of the stitches, the program can be increased with the addition of static exercises for the erector spinae. Progressive resistive exercises are beneficial for the atrophied and weakened lower extremity.[11] With a set program of resistive exercises, rapid improvement to normal muscle tone is readily seen.

When the patient begins to sit up in bed, "pant bracers" give added immobilization for weakened back muscles. The patient continues to wear the bracer for at least four weeks during which period ambulation is begun. As the patient's condition improves, the therapy is increased.

Exercises for rotation of the spine may be started at this time. The patient stands before a mirror and places his arm overhead. The upper part of the body is rotated on a vertical plane from the waist, to the left and then to the right. To increase flexion and extension of the spine, the simple "three-way stretch routine" and knee to chest exercises are recommended as illustrated in figures 3 and 4. The patient should continue to perform these exercises before getting out of bed in the morning and the last thing before retiring, for at least one year.

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[11] Delorme, Thomas L. Restoration of Muscle Power by Heavy Resistance Exercises, J. Bone & Joint Surg 27:645 (Oct) 1945

No matter what type of immobilization has been used during the convalescent stage, it is important that the program of postoperative muscle therapy be emphasized. By doing so, good muscle tone rather than a weakened back will be the result when the immobilization is removed.

In the past, spinal fusion patients remained flat in bed for six months without benefit of exercises, and when ambulatory, were immobilized in some form for another six months. Such a program resulted in a long list of invalids. With the progress of medicine, new techniques in bone surgery, and the knowledge of muscle physiology, we have found that long periods of immobilization without any muscular activity are harmful.[12] Under the new regime of postoperative therapy, patients who have had discs removed, with or without spinal fusion, are not handicapped but able to return to normal activity and to their jobs.

In the majority of cases to be rehabilitated, the type of work the patient has done prior to his discogenic disease must be considered. The entire program should be directed toward that goal, whether the patient be an administrator who sits at his desk, a carpenter, mechanic, or laborer. The final phase in the rehabilitation program must simulate the activities the individual will perform when he returns to his occupation.

We have found that rather than wait until a patient is fully able to return to work, he should be given some activity within his physical capacity, and with continued rehabilitation during this time, finally be returned to his previous employment.

Summary

A program of rehabilitation for the patient with a herniated intervertebral disc following surgery is described. The program is based on the "low back residual syndrome" classification of mild, moderate, and severe groups. The treatment of the residuals such as spasm, contractures, and atrophy of the lower back muscle groups as well as the entire affected lower extremity is discussed. The success of the total rehabilitation of the patient with a herniated intervertebral disc, stressing both the pre- and post-operative therapy, will depend largely upon the emphasis placed on the program of rehabilitation.

Discussion

Dr. Shelby G. Gamble (Cleveland, Ohio): The authors have stressed the fact that residual distress following surgery for a ruptured intervertebral disc is related primarily to changes in the muscular and supporting tissue elements as they affect posture and body mechanics rather than the surgery performed on the disc and the vertebrae. I sincerely believe that in as far as we know this is correct, as we often see the same residual in patients who have undergone surgery by very capable individuals with a diagnosis agreed upon by several competent consultants and yet at the time of surgery no ruptured intervertebral disc is found. The majority of these patients as well as some patients with "discs" show either complete or marked improvement on a conservative program similar to that outlined here so that no other explanation can be accepted as concerns the beneficial factor.

In the classification of cases as well as in the etiology of objective neurological signs we should all remember that the angle and degree of protrusion of the disc is important. Also, in our post-operative program it is necessary to consider the extent of bony unroofing performed at the time of surgery as well as whether or not intervertebral or extra-vertebral fusion was also performed. Therefore it is necessary to have satisfactory cooperation between the surgeon and the physiatrist as to how early active exercises of any degree can be initiated to the spine and whether or not any portion of the spine needs to be protected by varying degrees of immobilization. Operative notes in most institutions will not answer these questions, since they are too all inclusive and routine, so that personal discussion of the case is advisable.

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[12] Spurling, R. Glen, and Grantham, Everett G.: Ruptured Intervertebral Disc in the Lower Lumbar Regions, Am. J. Surg. 75:140 (Jan.) 1948.

Certainly a presurgical program is most worthwhile, as the authors have stated. Obviously those patients with marked objective neurological changes seldom benefit as far as correction of the protrusion is concerned. The prime consideration is, of course, the proper preparation of the patient for the post-operative program as early as indicated.

Every operated case must be individualized. The eventual occupational duties are very important in deciding on the type and duration of support. Support alone, without proper physical therapeutic measures to obtain and maintain the objectives as listed by the authors, is probably the most important single etiological factor in prolonged residual low back distress.

The authors are to be commended for their fine presentation of a very common but very *important* and *difficultly manageable* condition.

CONTINUOUS OXYGEN-AEROSOL FOR THE TRACHEOTOMIZED RESPIRATOR PATIENT

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and

JOSEPH N. SCHAEFFER, LT. COL., USAF (MC)†

The purpose of this report is to present a device for continuous administration of an oxygen-rich aerosol mixture to tracheotomized patients in a tank-type respirator.

Invariably the tracheotomy is accomplished to maintain an airway. The tracheotomy by-passes the nares and nasopharynx, which normally provide a large portion of the humidity for the inspired air. In patients with a tracheotomy, the trachea and bronchi must take over the function of humidification.

The physiological drainage of the tracheobronchial tree depends on the tussive squeeze and the expulsive blast during coughing and the ciliated epithelium to move the secretions centrally. Lack of adequate moisture in the inspired air allows the transfer of water in the vapor phase from the mucous membrane to the respiratory gases. This all too quickly leads to dehydration and resultant inspissation of the mucous lining of the bronchial tree. When inspissation is allowed to continue, the increased viscosity of the layer of mucus prevents normal function of the cilia. Obstruction of bronchial lumen occurs in the smallest divisions initially followed by patchy atelectasis. In addition to the mechanical obstruction of the airway afforded by the inspissated mucus the foundation for infection is established.

Air or oxygen, 100 per cent saturated with water vapor at room temperature, would still require some moisture from the tracheobronchial mucosa because of the rise in temperature as the air is pulled into the lungs. Therefore, it is felt that the introduction of an aerosol of proper droplet size is essential to prevent drying of the mucosa and its rapid sequelae. The aerosol can also be used as a vehicle for the deposition of topical agents upon the respiratory mucous membranes.

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Background

Holinger, et al.[1] reported their studies on the physical and chemical properties of respiratory secretions. The secretion of the smaller divisions of the segmental bronchi and bronchioles was observed to be more viscid in the periphery of the tree. These workers described dry oxygen as an "anti-expectorant."

Albers[2] in 1943 reported the use of a nebulizer to produce oxygenated vapor. This device was applied to a pediatric patient in whom tracheotomy had been performed for acute laryngotracheobronchitis. Albers' objective was to prevent the dehydration of the inflammatory secretions which so frequently leads to mechanical obstruction and atelectasis. Essentially the same rationale was expounded by Baker[3] who described a "Tracheotomy Inhaler" designed by Kubicek[4] to deliver a measured amount of moistened air and oxygen mixture directly through the tracheotomy tube. Bower[5] and associates in their report from the poliomyelitis center at Los Angeles County Hospital stressed the importance of adequate humidification of the atmosphere breathed by their tracheotomized patients during respirator care. The rationale of the use of a nebulizer to deliver a supersaturated oxygen-rich atmosphere is based on the mechanical deposition of microscopic particles of liquids on the mucous membranes as Abramson[6] described in his report on aerosol therapy.

The Mist-O_2-Gen nebulizer, as reported by one of us[7] delivers a large volume of oxygen-aerosol at ranges of four to eight liters per minute of oxygen flow. The nebulizer incorporates a self-feeding design which insures continuous operation over a period of eight hours before the reservoir must be refilled. The volume output of aerosol is estimated to exceed that of standard nebulizers by three hundred per cent. The reliable performance of this nebulizer has been observed in several medical centers during the past two years. In addition to a supply of water in microscopic particles, various solutions may be nebulized for specific therapeutic purposes. Thus, topical agents such as antibiotic drugs, shrinking substances, and antispasmodics, may be added to the aerosol to control infection, edema and local spasm.

It was postulated that many of the respiratory complications occurring in tracheotomized respirator patients could be prevented if the oxygen-rich aerosol from a Mist-O_2-Gen nebulizer could be conveyed to the tracheotomy tube. The application of previous techniques[7] using a tent was considered, but it was discarded because of technical difficulties. Therefore, an apparatus to conduct a continuous flow of oxygen-rich aerosol from the Mist-O_2-Gen nebulizer to the tracheotomy opening was developed. This device is constructed of rigid clear plexiglass, so that the flow of aerosol, the character of the respirations, and the patency of the tracheotomy tube can be observed. It consists of an adapting port fitted to the outlet of the nebulizer coned down to a 1¼ inch plexiglass conduction tube. The tube is curved to conform to the contour of the space between the patient's chin and the respirator collar (fig. 1).

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[1] Holinger, Paul, et al.: The Influence of Expectorants and Gases on Sputum and the Mucous Membranes of the Tracheobronchial Tree, J. A. M. A. 117:675 (Aug. 30) 1941.

[2] Albers, G. D.: Use of a Nebulizer to Produce Oxygenated Vapor, Proc. Staff Meet., Mayo Clin. 18:511 (Dec. 29) 1943.

[3] Baker, A. B.: Bulbar Poliomyelitis, Its Mechanism and Treatment, Am. J. Med. 6:614 (May) 1949.

[4] Kubicek, W. G., et al.: Oxygen Therapy in Poliomyelitis, Arch Phys. Med. 29:217 (April) 1948.

[5] Bower, Albert G.; Bennett, V. Ray; Dillon, John B., and Axelrod, Bernard: Investigation on the Care and Treatment of Poliomyelitis Patients, Ann. West. Med. and Surg. 4:561 (Oct.-Nov.) 1950.

[6] Abramson, H. A.: Principles and Practice of Aerosol Therapy of the Lungs and Bronchi, Ann. Allergy 4:3, 1946.

[7] Denton, Robt., and Smith, Robert M.: Portable Humidifying Unit. II. Large-Capacity Metal Nebulizer, Am. J. Dis. Child. 82:433 (Oct.) 1951.

At the apex of the curve on the inferior surface, there is an oval opening. This opening is extended ½ inch by a plastic collar on which a sponge rubber gasket is placed. The sponge rubber ring contacts the neck around the flange of the tracheotomy tube, without touching the tube or flange at any point. The entire weight of the device is carried on the Mist-O_2-Gen nebulizer so that only the desired pressure to insure contact is exerted on the neck of the patient (fig. 1).

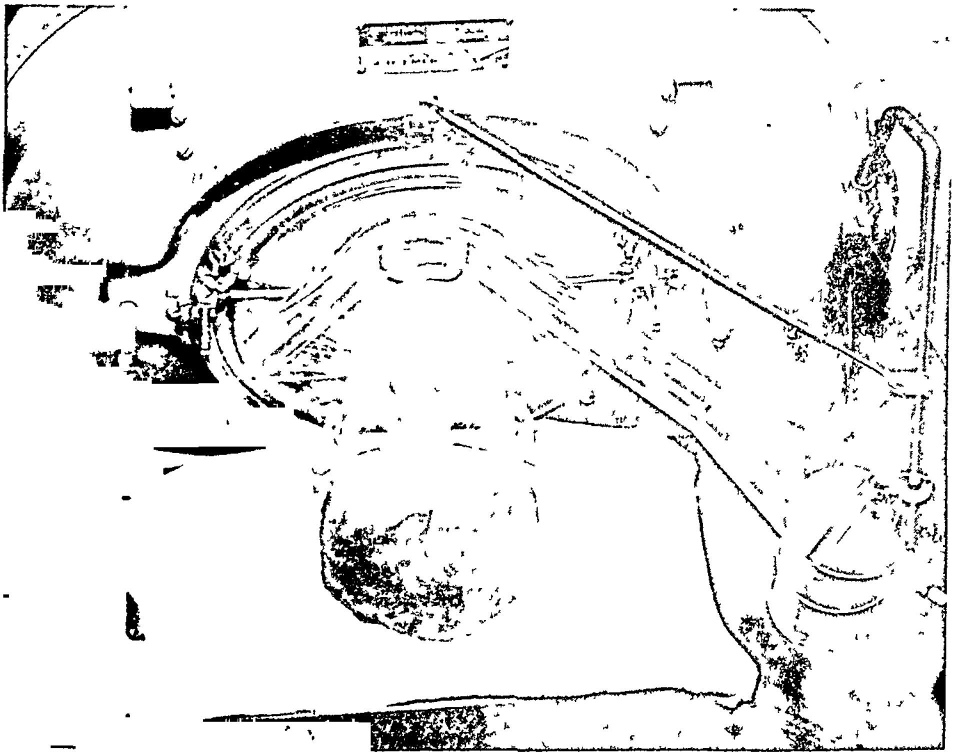


Fig. 1. — Apparatus in place on respirator showing Mist-O_2 Gen nebulizer, supporting bracket and transparent conduction tube. Note the visibility of the tracheotomy orifice and the support of the conducting tube on the nebulizer

The plexiglass conduction system is attached to the Mist-O_2-Gen nebulizer by slipping the cone adapter over two mounting pins on top of the nebulizer (fig. 1). The nebulizer is mounted on an adjustable bracket which fits into a sleeve on the front of the respirator. Thus, the entire device becomes rigidly fixed to the frame of the respirator and cannot be inadvertently dislodged from its position of function. The plexiglass tube is so constructed that with one simple motion it can be immediately removed from the patient's neck (fig. 2) allowing the attendant to instantly expose the tracheotomy tube for suction, cleansing, etc.

The apparatus functions in the following manner: Oxygen-rich aerosol as generated in the Mist-O_2-Gen nebulizer is adjusted to flow through the plexiglass tube at the rate of 4-8 liters per min., depending on the patient's minute-volume. On inspiration, a negative pressure is created at the orifice surrounding the tracheotomy lumen, allowing the oxygen aerosol mixture to flow into the respiratory tree (fig. 3-A).

Because of the constant flow of oxygen aerosol in the conduction tube, the distal segment is continuously filled with the desired mixture. This pro-

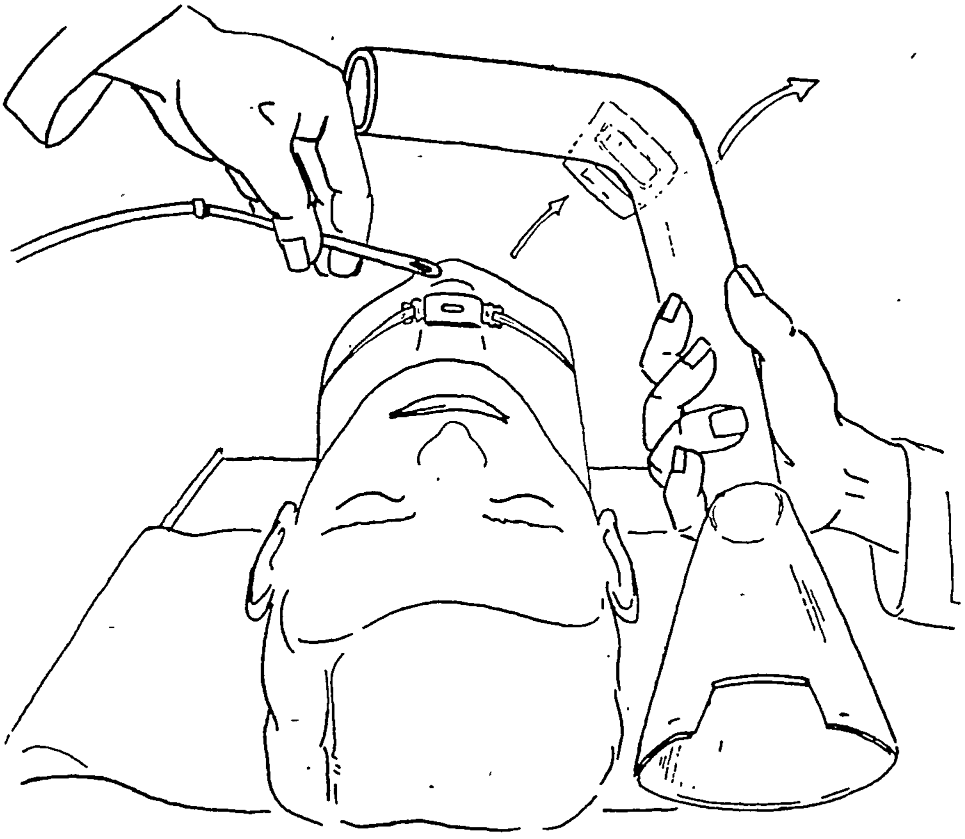
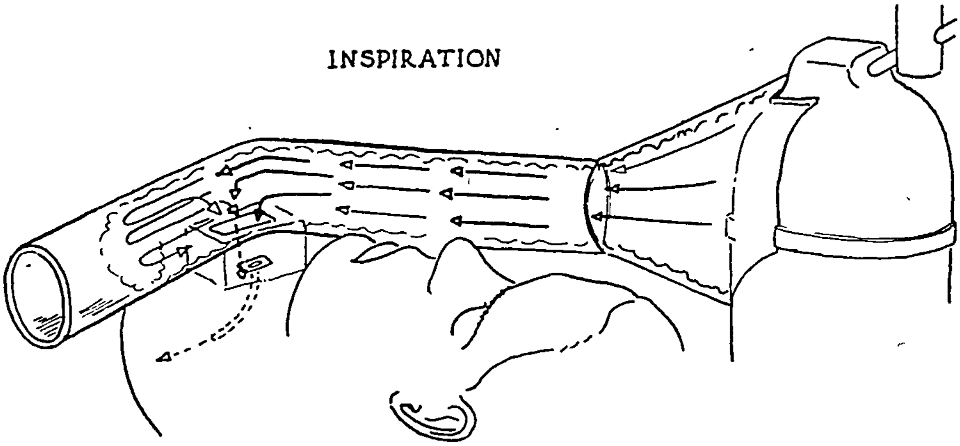
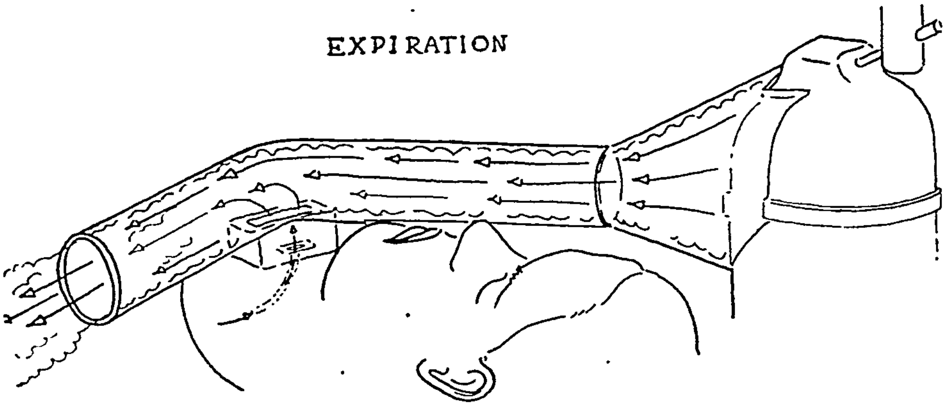


Fig. 2. — One simple motion exposes the orifice of the tracheotomy tube for suctioning.





Figs. 3-A, and 3-B. — Arrows indicate the course of the oxygen-rich aerosol on inspiration and expiration.

vides a safety cushion to prevent back flow of room air to the patient. On exhalation, the flow of oxygen aerosol across the tracheotomy tube assures complete removal of expired gases, and prevents rebreathing (fig. 3-B).

This device and several prototypes have undergone clinical trials with satisfactory results in approximately ten tracheotomized patients. The "toilet" of the tracheo-bronchial tree was maintained in each of these cases and pulmonary complications were either resolved or prevented by the technique described herein. The authors recognize the deficiency of clinical experience at this time but the results obtained in the initial series were sufficiently impressive to warrant this preliminary report.

With the apparatus presented in this report, a supersaturated, oxygen-rich atmosphere can be continuously delivered to the respirator patient's pulmonary tree through the tracheotomy tube. A specific design has been employed to permit visualization and immediate access to the tracheotomy tube. Application of this technique will materially aid in the maintenance of the normal physiology of the respiratory tract.

The Mist-O_2-Gen nebulizer and the design for the tracheotomy adapter reported herein were employed with the permission of the Production Foundry Corporation, Oakland, California.

THE TILTED CRUTCH HANDPIECE

HERBERT W. PARK, M.D.*
ELEANORE W. MALONE, R.P.T.†
and
RUTH STEGLICH, O.T.R.‡

When the normal mechanics of posture and gait are discussed, the principle of weight bearing through good body alignment is always stressed as being an important factor in optimum posture, endurance and comfort. In such considerations, little attention is given to the upper extremities since they are not concerned in the weight bearing process. However, in the crutch walker the axiom is applicable to the upper extremities and is of utmost importance. A review of the literature reveals that rightful significance has been placed on proper crutch length and correct use of crutches; but, so far as can be determined, no consideration has ever been given to the position of the crutch handle.

On considering the functional anatomy of the hand, it is observed that the thenar eminence is much fuller and extends more distally than the hypothenar eminence. As a result, when a free rod is firmly grasped it assumes an angulated position (Figure 1). On examining 35 subjects, this angle was found to range from 5 to 30 degrees with the measurement on 73 per cent of the subjects ranging from 20 to 25 degrees. In 60 per cent examined, the angulation differed between the right and left extremities. In order to correct the angle of the rod to a position perpendicular to the fore arm, radial deviation was required Similarly, it was observed that when a subject bore maximum weight on a conventional crutch handle, the wrist assumed a position of radial deviation (Figure 2).

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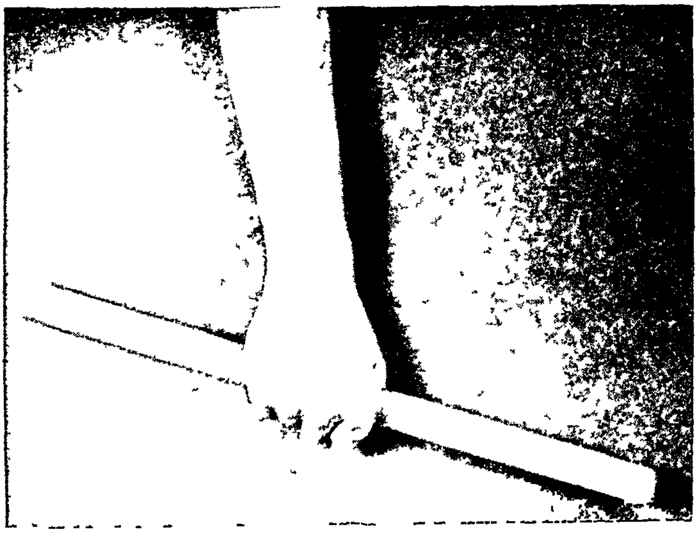

Figure 1 — Relation of a free bar to the forearm when the wrist is in good weight bearing alignment

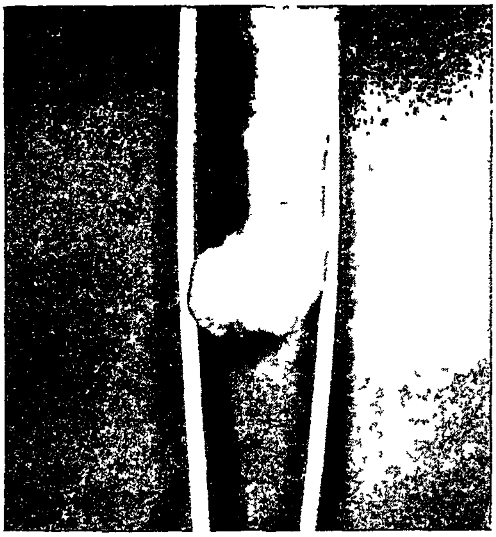

Figure 2 — Demonstration of alignment of hand, wrist, and forearm with the conventional horizontal crutch handpiece

On the basis of these observations and data, the crutch handpiece was altered to meet the individual's needs (Figure 3). As is observed in Figure 4, there is good weight bearing alignment through the wrist All patients who have a tilted crutch handpiece state that the crutches are more comfortable to use than with the conventional handle. It is the clinical impression that by improving the weight bearing alignment through the wrist, fatigue will be lessened, blisters fewer, crutch palsies rarer, and the crutches more readily used.

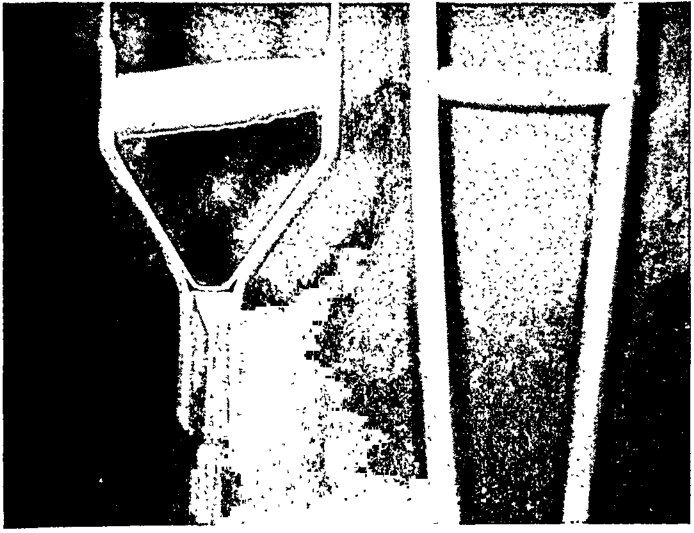

Figure 3. —Comparison of conventional and tilted crutch handpiece

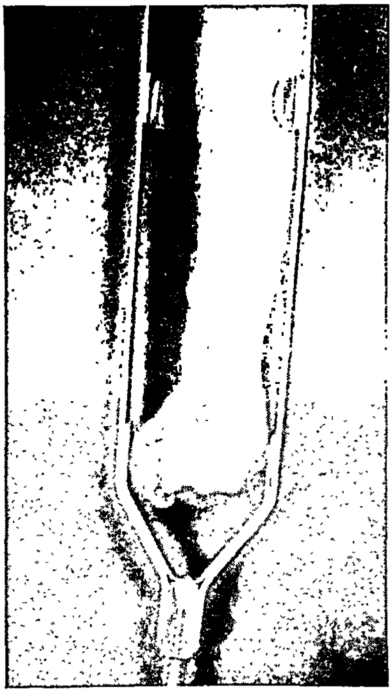

Figure 4. — Demonstration of alignment of hand, wrist, and forearm with a corrected crutch handpiece.

MEDICAL NEWS

Members are invited to send to this office items of news of general interest, for example, those relating to society activities, new hospitals, education, etc. Programs should be received at least three weeks before the date of meeting.

Congress Participants at A.M.A. Clinical Session

The following scientific exhibits were presented by Congress members at the clinical session in Denver:

Howard A. Rusk, M.D., and Michael Dacso, M.D., New York, N. Y., "Rehabilitation of the Aged"; *Harold Dinken, M.D., Denver, Colorado,* "Physical Medicine in the Treatment and Rehabilitation of Rheumatic Diseases" and "Physical Medicine and Rehabilitation in Traumatic Conditions"; A. W. Schenker, New York, N. Y., "Residual Poliomyelitis: A Technique for Rapid Restoration of Function"; John H. Kuitert, Lt. Col. (MC), U. S. A., Washington, D. C., "Creative Expressions of a Reintegrating Personality"; Joseph N. Schaeffer, Lt. Col. (MC), U. S. A. F., "Continuous Oxygen-Rich Aerosol for the Tracheotomized Respirator Patient"; Grace M. Roth, M.D., Rochester, Minn., "Pheochromocytoma, A Cause of Hypertension-Diagnosis and Surgical Treatment" and Ralph E. DeForest, M.D.; Frederic T. Jung, M.D., and Howard A. Carter, M.E., Chicago, "Special Exhibit on Artificial Respiration."

Rehabilitation Award

Dr. Henry H. Kessler of Newark, N. J., was recently presented with a physician's award by the President's Committee on Employment of the Physically Handicapped. Each year, a physician will be awarded for making the greatest contribution to the welfare and employment of the physically handicapped.

Graduation Exercises Held at Northwestern University

Graduation exercises for the thirty-first class in physical therapy at Northwestern University Medical School were held on October 3, 1952.

In the absence of Dr. Stafford L. Osborne,* Professor Emeritus of Physical Medicine and Acting Chairman of the Department, Dr. Charles Molander, Assistant Professor of Physical Medicine, presided and presented certificates in physical therapy to fifteen graduates.

The Physical Therapy Alumni Association of Northwestern University Medical School honored both the graduates and Miss Gertrude Beard, retiring technical director, at a dinner following the graduation exercises.

Drug Distribution Permitted

The Food and Drug Administration of the Federal Security Agency has announced its decision to permit the continued distribution of the antibiotic drug Chloromycetin under revised labeling that will caution physicians explicitly against its indiscriminate use.

Reports of blood disorders attributed to Chloromycetin led to a nation-wide survey by the FDA of the case records in hospitals and clinics. The case histories turned up by this survey were referred to the National Research Council for its aid in evaluating the information. FDA's decision was based on the findings and recommendations of a special committee of the Council's Division of Medical Sciences.

It is estimated that since the drug came on the market in 1949, it has been administered to something like eight million patients.

The labeling of Chloromycetin will be changed to include the following warning:

"Certain blood dyscrasias (aplastic anemia, thrombocytopenic purpura, granulocytopenia and pancytopenia) have been associated with the administration of Chloromycetin. It is essential that adequate blood studies be made when prolonged or intermittent administration of this drug is required. Chloromycetin should not be used indiscriminately or for minor infections."

"WARNING: Blood dyscrasias may be associated with intermittent or prolonged use. It is essential that adequate blood studies be made."

Pennsylvania Academy Meets

At the October meeting of the Pennsylvania Academy of Physical Medicine and Rehabilitation, the following subject was presented: "Spa Treatment in the Commonwealth of Pennsylvania." Color slides were used to illustrate the material.

Liebel-Flarsheim Opens New Plant

Dual Open-House programs marked the opening of the new Liebel-Flarsheim plant at 111 East Amity Road, Cincinnati, Ohio. More than a thousand visitors heard the opening ceremonies on October 4th and saw the working side of one of the nation's largest electromedical manufacturing plants. On October 18th, a second and equally important Open-House was attended by medical, professional, and business friends.

(Continued on Page 736)

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* Deceased

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.·. EDITORIAL .·.

THE SOCIAL AND PSYCHOLOGIC ASPECTS OF PHYSICAL MEDICINE AND REHABILITATION

In a current article on medical education, Lester Evans,[1] executive associate of the Commonwealth Fund, in discussing "The Next Twenty Years in Medicine," concluded that teaching and research centers must learn to coordinate their activities "if modern medicine is to deal with man as a whole." If we consider not only the physical aspects of disease but also the social and psychologic aspects, we can develop a type of medical practice which, according to Evans, will have "its roots in the lives and needs of the people."

In a new book by Max Pinner and Benjamin Miller[2] entitled *When Doctors Are Patients,* a group of physicians have described their own personal experiences with various serious diseases. It is a revelation to discover that almost every one of these physicians, as he recited the problems which he faced in dealing with his own serious illness, stressed, almost invariably, the psychologic and social aspects of his disease. This led the late Dr. Max Pinner, one of the editors of this volume, to conclude in his preface that "This collection of case reports can only emphasize again and, I believe, in a peculiarly urgent and moving way, how essential it is to treat the whole patient." Pinner added, "The first need is not, in my opinion, diagnosis and specific treatment of so-called psycho-somatic diseases, but the recognition — which is not new, but so frequently forgotten and ignored — that every disease is psycho-somatic, that is, that it affects both body and soul."

In the current report of the president of the Rockefeller Foundation, Chester I. Barnard[3] in discussing medical care commented, "The old idea that biophysics and biochemistry would eventually unravel all the problems of health and disease is less tenable today than was the case forty or fifty years ago. There is a growing realization that inter-related social factors outside of the physics and chemistry of the body are also involved." Barnard concluded, "When research has accumulated and systematized the data into a scientific discipline, bio-social medicine may become an indispensable part of the school curriculum. We may expect medical schools then to introduce students to the practice of community medicine with an emphasis on 'social diagnosis' comparable to that on physical diagnosis."

Physicians who specialize in physical medicine and rehabilitation have given more consideration than any other group of specialists to the philosophy of considering each patient "as a whole" and to the importance of considering not only the physical but also the psychologic and social aspects of every case. Physiatrists have already made an auspicious beginning in fostering and expanding this trend which is of great importance to the future of the specialty.

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[1] Evans, L. J.: The Next Twenty Years in Medicine, J. Med. Education 27:326 (Sept.) 1952.

[2] Pinner, M., and Miller, B. F.: When Doctors Are Patients. New York, W. W. Norton & Company, 1952, pp. 364.

[3] Barnard, C. I.: *The Rockefeller Foundation. A Review for 1950 and 1951.* New York, Rockefeller Foundation, 1952, pp. 126.

If physiatrists will continue their efforts to accumulate and systematize the data on biosocial medicine, the specialty of physical medicine and rehabilitation may well become the "scientific discipline" mentioned by Barnard. The three references which have been mentioned emphasize the tremendous importance of this phase of our work. An enormous expansion in the range of our services to the sick and disabled will inevitably result, provided that we physiatrists continue to enlarge our interests and to deal with man as a whole by considering not only the physical but also the social and psychologic aspects of each disease or disability which is encountered.

FRANK H. KRUSEN, M.D.

Medical News

(*Continued from Page 734*)

Grants

The National Foundation for Infantile Paralysis, as a result of the 1952 March of Dimes, has awarded the following grants: $24,500 to Harvard University School of Public Health to continue studies on breathing difficulties of polio patients and to develop and evaluate new methods for improving the care of such conditions; $24,650 to Duke University at Durham, N. C., for making medical movies; $2,150 to Duke Hospital to provide more physical therapy service for Lincoln Hospital.

Statewide Rehabilitation Conference

The first Statewide Rehabilitation Conference was held in Indianapolis, Indiana, on December 4-5, 1952. The conference, a forerunner of a series, plans to: bring together therapists, specialists and professional people from various fields; interpret Indiana's rehabilitation services; review what services are available and from what agencies they may be obtained; stress the importance of inter-agency cooperation and the advantages of dovetailing the various rehabilitation programs.

Personals

Jerome W. Gersten, M.D., Denver, Colorado, has been promoted to associate professor of physical medicine and rehabilitation. **George C. Twombly**, Jr., M.D., has been promoted to assistant professor of physical medicine and rehabilitation. Both Doctors Gersten and Twombly are on the faculty of The University of Colorado School of Medicine at Denver.

Emil J. C. Hildenbrand, M.D., Washington, D. C., has been elected Secretary of the Washington Medical and Surgical Society.

Howard F. Polley, M.D., Rochester, Minn., presented the topic "ACTH and Cortisone in Arthritis" at The Sixth Councilor District Postgraduate Day held in Youngstown, Ohio, in October.

Dr. **Walter J. Treanor** was married in New York on September 27 to Miss Patricia F. O'Sullivan.

Dr. **Odon F. von Werssowetz** of Nashville, Tennessee, was a guest speaker at The Omaha Mid-West Clinical Society meeting in October.

Dr. **John W. Deyton** of Okmulgee, Oklahoma, participated in the annual conference held by The National Rehabilitation Association at Louisville, Ky., October 19-23.

Dr. **Howard A. Rusk**, New York, N. Y., is a member of the Health Resources Advisory Committee. The committee is concerned with the health resources of the nation as they relate to national defense.

Herbert Kent, M.D., Indianapolis, Indiana, was chairman of a panel discussing the topic "Medical and Non-Medical Aspects of Rehabilitation," held at the Veterans Administration Hospital at Indianapolis on December 5.

Newly Registered Therapists

October 6, 1952

Doke, Louis C., Jr., 1018 W. 84th Pl., Los Angeles, Calif.

October 16, 1952

Domenech Munoz, Heriberto, Aquadilla Ave., Isabela, Puerto Rico.

Gross, Martha Ann, 711 Monroe St., St. Charles, Mo.

McDougall, Homer Boyd, 415 Summit St., Grove City, Pa.

Strittmatter, Wallace Stephan, 425a N. Illinois St., Belleville, Ill.

October 27, 1952

Adams, Barbara, 18 Rochester St., Lima, N. Y.

Adams, Barbara Francis, Pirineos 635, Mexico 10, D. F., Mexico.

Aho, Grace Marie, 1028 W. Dayton St., Madison, Wis.

Asarnow, Martin Philip, 84 Hobson St., Newark 8, N. J.

Atkinson, Marilyn June, R. R. 1, Hudson, Wis.

Augustin, Edwin Beecher, Woodrow Wilson Rehabilitation Center, Fishersville, Va.

Aumueller, Blanche Anna, 5360 W. Fond du Lac Ave., Milwaukee, Wis.

Beirponch, Michael, 240 Martin, Hartford, Conn.

Bell, Jane, Bellwood Pl., Orangeburg, S. C.

Below, Bonnie Lou, 328 Garfield St., Stanley, Wis.

Bemis, Suzanne Harwood, 4747 21st N. E., Seattle 5, Wash.

Berberian, Albert J., 64 Circuit St., Roxbury, Mass.

Blomgren, Carol Virginia, 330 Rogers St., Milton, Wis.

Braatz, James H., 609 W. Graham Rd., Richmond, Va.

Brown, Robert Preston, Jr., 102 W. Mason Ave., Alexandria, Va.

Bryan, Martha, 606 Second Ave., Opelika, Ala.

Burks, Raymond Albert, 1631 Johnson Rd. N. E., Atlanta, Ga.

Chelemsky, Samuel, 5243 Lebanon Ave., Philadelphia 31, Pa.

Clifton, Via Virginia, % Mrs. William J. Murray, 3200 Kenilworth Ave., Hyattsville, Md.

Cook, Mary Jo, 201 N. 21st Ave., Hattiesburg, Miss.

Dixon, Malcolm Callaway, 54 New York Ave., Brooklyn 16, N. Y.

Dobbs, Jo Kathryn, 2909 Central Ave., Birmingham, Ala.

Duerr, Richard Michael, Jr., 2646 N. Bremen St., Milwaukee, Wis.

DuLaney, Albert Robert, 5355 Waveland Ave., Chicago 41, Ill.

Emery, Lyle Carson, 1217 N. 26th St., Lincoln, Nebr.

Erickson, Mary Ann, 1653 N. Marshall St., Milwaukee, Wis.

Flowers, Nancy Carolyn, 813 Poplar Blvd., Jackson, Miss.

Fryer, Charles Martin, 1006 Freeman St., Bronx 59, N. Y.

Garrison, Martha Bird, Box 366, Clarkesville, Ga.

Golson, Ruth, 118 First St., Prattville, Ala.

Goudelock, Ann Hamilton, 505 S. Hayne St., Monroe, N. C.

Hanson, Helen Alice, P. O. Box 155, Walden, Colo.

Hauenstein, Spencer William, 546 Valley Rd., Upper Montclair, N. J.

Hirokawa, Richard T., 1739 Huli Lane, Honolulu, Hawaii.

Hoffland, Nancy Mary, 1042 Spaight St., Madison, Wis.

Holmes, Willard Powell, 72 Brett, Brockton 8, Mass.

Hornbeck, Shirley Louise, Holcolm Lane, P. O. Box 1966, Reno, Nev.

Hull, Howard, 285 Irving Ave., Brooklyn 37, N. Y.

Humphrey, Tommy Lee, 12486 El Merrie Del., San Fernando, Calif.

Jacoby, Robert, P. O. Box 74, Hub Station, Bronx 55, N. Y.

Johnson, Lois Ruth, 3140 32nd Ave. S., Minneapolis 6, Minn.

Johnston, Judith Elaine, Box 917, Delray Beach, Fla.

Jones, Shanna Lee, 1106 Shrader, San Francisco, Calif.

Kahn, Anne, 1106 California Ave., Peoria, Ill.

Kamb, Ronald Eugene, 2427 Roosevelt Ave., Richmond, Calif.

Kampmeier, Lois Jean, 1322 Edanola Ave., Lakewood 7, Ohio.

Kemp, Richard Brenne, 4515 N. St. Louis Ave., Chicago 25, Ill.

Kossack, Samuel, 2054 Harrison Ave., New York 53, N. Y.

Koster, Jack Warren, 1430½ Harrison St., Davenport, Iowa.

Kuhnert, Mary Martha, Market St., Nekoosa, Wis.

Lamberson, Martha Ellen, R. R. 2, Connersville, Ind.

Lenn, Kaye Bailey, P. O. Box 126, Heron, Mont.

Levesque, Mary Ann, Enfield, N. H.

Lillis, John Francis, 641 Liberty Ave., Jersey City, N. J.

Lueth, Betty Irene, R. F. D. 1, Harvard, Ill.

Luhdorff, Elaine Elinor, 33 Pershing Ave., Woodland, Calif.

MacDonald, Mary Elizabeth, 2228 Victoria Ave., Windsor, Ont., Can.

Mandragos, Dorothy S., Rt. 1, Box 40, Brandywine, Md.

Markoff, Richard Allen, 815 Hick St., Brooklyn 31, N. Y.

Martin, Mary Katherine, 223 S. E. Third St., Evansville, Ind.

McCarrell, Walter Leon, Rt. 1, Travelers Rest, S. C.

McKenzie, Donald Kennedy, 2320 Tremainsville Rd., Toledo 13, Ohio.

Melnicki, Alexander C. H., 85 Emerson Pl., Brooklyn 5, N. Y.

Mende, Elizabeth Rae, 2508 Melbourne Ave., Richmond 23, Va.

Mickelborough, Ramona Gladys, Box 693, Port Sulphur, La.

Miller, Anne Bowie, 1016 Massachusetts Ave. N. E., Washington, D. C.

Molnar, Margaret O., 16316 Throckley Ave., Cleveland 28, Ohio.

Nelson, Yvette Eloise, 1578 Pimpernel Ave., Baton Rouge, La.

Nilson, Patricia, Old Post Rd., Walpole, Mass.

Niquette, Mary Lois, 2017 Main St., New Holstein, Wis.

Orleans, Sarah Grace, 100 Arden St., New York 34, N. Y.

Pigeon, Pauline Yvette, 1823 P. St. S. E., Washington 20, D. C.

Portnoy, Miriam D., 320 W. 87th St., New York, N. Y.

Pozarny, Louis, 196 Brunswick Blvd., Buffalo 8, N. Y.
Prince, Dudley Edward, 323 Main St., Norwalk, Conn.
Reed, Doris Elizabeth, 422 Cayuga Hts. Rd., Ithaca, N. Y.
Reimer, Erika Katherine, 2933 N. 7th St., Milwaukee, Wis.
Resch, Caroline S., 111 Dunham Rd., De Witt, N. Y.
Rhodes, Eloise, Crippled Children's Bur., State Health Dept., Richmond 19, Va.
Rieder, Edward Elliott, Grasslands Hospital, Valhalla, N. Y.
Ropes, Margaret Ann, R. D. 1, East Sparta, Ohio.
Scotten, Shirley Anne, 4424 Hastings, El Paso, Texas.
Sneed, Sara W., 301 College Ave., Ashland, Va.
Solomon, Morris, 850 Southern Blvd., Bronx 59, N. Y.
Swanson, Mary Marshall, Linden Ave., Branford, Conn.
Szwalek, Leo Francis, 140 Glendale Ave., Saginaw, Mich.
Thomas, Melba Lenora, 1766 W. Ninth, Jacksonville, Fla.
Thomas, Owen Penri, 1359 N. 79th St., Seattle, Wash.
Tucker, William Earl, Jr., 24 Dunvegan Rd., Catonsville, Md.
Ussher, Beth, 128 E. Pedregosa St., Santa Barbara, Calif.
Van Ark, Virginia, 123 N. East St., Eaton Rapids, Mich.
Vaughan, Marjorie Louise, 37 Quincy Pl. N. E., Washington, D. C.
Wald, Marilyn Muir, 3430 7th Ave., Rock Island, Ill.
Walters, Margaret Jean, 1510 75th St., Kenosha, Wis.
Wheeler, Glen Leslie, 301 N. Lake St., Madison, Wis.
White, Nancy, 417 S. 13th Ave., Bozeman, Mont.
Wiseman, Raymond Robert, Rt. 2, Box 2135, Rio Linda, Calif.
Wood, Mary Kathleen, 1383 Mathews Ave., Lakewood, Ohio.
Zimmerman, Robert Norman, 42-43 195th St., Flushing 58, N. Y.

November 3, 1952

Allen, Wayne Francis, Box 104, Dillon, Colo.
Bowdish, Eugene Robert, 935 E. College St., Iowa City, Iowa.
Bretz, Ruth Lee, 214 Fourth St., Huntingburg, Ind.
Childs, Gretchen Baker, Twin Orchards, Hampden, Mass.
Collier, Nancy, R. R. 1, Elkhart, Ind.
Cornell, Leone Daphne, 323 E. Madison, Wheaton, Ill.
Davies, Evan Vaughan, 330 First St., Slatington, Pa.
Edd, Carl A. B., 547 Simmons Ave. S. E., Huron, S. Dak.
Emel, Thomas Dean, 1630 W. 6th, Hastings, Nebr.
Floyd, Carla Joanne, P. O. Box 1223, Winter Park, Fla.
Fouhy, Phyllis Rose, 452 New Scotland Ave., Albany, N. Y.
Gillespie, Robert Wise, 5520 N. Federal Blvd., Denver, Colo.
Gordinier, Mary Tait, 1280 Albion St., Denver 7, Colo.
Henry, Mary Anne, C.M.R., 158 Detweiller Dr., Peoria, Ill.
Hilfrank, Marcia Bodden, 219 Melrose St., Melrose, Mass.
James, Herma Helene, 228 W. 14th Ave., Denver, Colo.
Kaneko, Alice Miyoko, 5562½ W. Adams Blvd., Los Angeles 16, Calif.
Keith, Leonard Vane, 1105 Maple Ave., Tempe, Ariz.
Kelly, Helen Colleen, 1155 Grove Terr., Dubuque, Iowa.
Kelly, Jeanne Ellen, Westbranch, Mich.
Kitagawa, Mieko Margaret, 4004 Garfield, S., Minneapolis, Minn.
Knubel, Helen Alice, 43 Rockland Pl., New Rochelle, N. Y.
Kortemeyer, Elmer John, Jr., 3800 S. Galapago, Englewood, Colo.
Kortemeyer, Joy Gillespie, 3800 S. Galapago, Englewood, Colo.
Larson, Phyllis Ann, 502 Bevington Rd., Pittsburgh 21, Pa.
Lint, Joan Peggy, 353 Beach 143rd St., Rockaway Beach, N. Y.
Lisensky, Mary Herrick, 805 Clearview Ave., Crafton 5, Pa.
Martin, Donald Francis, 1428 Douglas St., Sioux City, Iowa.
McKinsey, Sara Jane, Helen Furnace, Pa.
Meyer, Margot Lambert, 31 Virginia Ave., Poughkeepsie, N. Y.
Miller, Norman Eugene, 1043½ Third St., Knoxville, Iowa.
Moody, Gene Ervin, Arcadia, Nebr.
Ohler, Robert Walter, 816 Ohio St., Alliance, Ohio.
O'Malley, William Bernard, 2207 Willis Ave., Perry, Iowa.
Pax, Dorothy Jane, 531 E. Anthony St., Celina, Ohio.
Proctor, Frederick John, 252 Hawkeye Village, Iowa City, Iowa.
Rathje, Erna Maurine, R. R. 1, Atkins, Iowa.
Sawyer, Evelyn Jule, 800 Loraine, Springfield Ill.
Skowlund, Helen Virginia, 17 Saratoga Ave., Oshkosh, Wis.
Smith, Sarah Irene, 1230 Western Ave., Albany, N. Y.

November 6, 1952

Angelici, Charles Pio, 3333 Portola Ave., Pittsburgh 14, Pa.
Barnhart, James Austin, 714 Brookwood Rd., Baltimore 29, Md.
Baudendistel, Helen Rose, 330 Casey Ave., Richland, Wash.

Brown, Shirley Irene, 1641 Monsey Ave., Scranton, Pa.
Christoffersen, Dorothy M., 1915 N. 74th Ave., Elmwood Park, Ill.
Collazo, Carmen, 201 Dieg de Andino St., Santurce, P. R.
Cope, Patricia Ann, 1044 Glamorgan, Alliance, Ohio.
Coursey, Junie Mae, 909 Fifth North St., Vicksburg, Miss.
Crawford, Garfield, 143 E. Newcomen St., Alcoa, Tenn.
Darkey, Doris Jean, Daily, W. Va.
Day, Delores Beth, 1625 S. East St., Lebanon, Ind.
Deaska, Mary Virginia, 7530 S. Coles Ave., Chicago, Ill.
Dworschak, Walter, 103 Johnson Ave., Malverne, N. Y.
Eary, Bessie Jones, 519 E. Main, Flushing, Mich.
Eiseman, Mary Alice, 4514 Amherst Lane, Bethesda 14, Md.
Evans, Audrey Louise, 220 N. Wilmette Ave., Westmont, Ill.
Graham, Elizabeth Anne, 1446 Greenmount Ave., Pittsburgh 16, Pa.
Greenberg, Victoria Lia, 600 W. 146th St., New York 31, N. Y.
Grime, Hazel Eleanor, 16 Milford St., New Bedford, Mass.
Hancock, George Dewey, Jr., James Ave., Shrub Oak, N. Y.
Heil, Carolyn Louise, 262 Graham St., Carlisle, Pa.
Helpy, Mary Lucy, 120 Center Ave., Pitcairn, Pa.
Hirschberger, Gloria Ann, R. 616, Somerset St., Johnstown, Pa.
Hufsey, James Coleman, 24 Cedar St., Millville, N. J.
Ireland, James Francis, 204 7th Ave., Carnegie, Pa.
Jackson, Wilmotine Brenda, 58 Solomon St. S. E., Atlanta, Ga.
James, Alice MacLean, 126 Simmons Ave., Cohoes, N. Y.
Janov, Howard George, 37 W. Centre St., Mahanoy City, Pa.
Jervis, Margaret Elizabeth, 414 E. Ainsworth Circle, Ypsilanti, Mich.
Karaveckas, Petronella D., 247 W. 7th St., Mt. Carmel, Pa.
Kern, Clifford William, P. O. Box 53, Patterson Creek, W. Va.
Kopler, Doris Jean, 1207 Frankstown Rd., Johnstown, Pa.
Kraft, Esther, 4715 Pulaski Ave., Philadelphia 44, Pa.
Kruse, Louis Harvey, R. D. 4, Box 482, Pittsburgh 9, Pa.
Kuhns, Jean Verner, 7937 Maderia St., Pittsburgh 21, Pa.
Lange, Gloria Lillian, 300 S. Cornell Ave., Villa Park, Ill.
Lavin, Edwin, 5354 Locust St., Philadelphia, Pa.
Lazorchak, Vera, R. 541, Maple Ave., Johnstown, Pa.
Lindberg, Joan Miriam, 507 Orchard Lane, Winnetka, Ill.
Lyons, John Joseph, R. D. 1, Downingtown, Pa.
Malcolm, Jean Crandall, 517 Prescott Rd, Merion, Pa.
McCauley, Catherine Mary, 215 Marshall Ave., Collingdale, Pa.
McDougall, Richard Vincent, Fredonia, Pa.
McNally, JoAnne Eugenia, 31 N. Walnut St., Blairsville, Pa.
Mehalko, Charles, 148 Third St., Vintondale, Pa.
Merwin, Alice, 39 Walworth Ave., Scarsdale, N. Y.
Mitinger, Lucy Kathleen, 116 Talbot Ave., Greenburg, Pa.
Neill, William III, 3917 Canterbury Rd., Baltimore 18, Md.
Nordlund, Thora Esther, 17 Schaefer Rd., Maplewood, N. J.
O'Connor, Paul Gregory, 4 Stuart Ave., Glenolden, Pa.
Paden, Jeanne, 1415 Baffin Rd., Glenview, Ill.
Pears, James E., 502 Bell Ave., New Castle, Pa.
Perrin, Esther Mae, 558 Baptist St., Greenwood, S. C.
Peters, Howard Klemmer, Jr., 48 E. Johnson St., Philadelphia 44, Pa.
Pujals, Charles, Jr., 4139 68th St., Woodside, L. I., N. Y.
Ray, Zehra Gene, Sledge, Miss.
Reven, Joan Mors, 201 S. George St., Mt. Prospect, Ill.
Riebel, Sister Mary Florentia, 502 E. Oklahoma Ave., Enid, Okla.
Rodriguez, Lumida, Box 784, Caguas, P. R.
Rogers, Shirley Ann, 236 Columbia Ave., Elyria, Ohio.
Stephenson, Marjorie Janine, 220 W. 4th St., Greensburg, Pa.
Sumner, Katherine Black, 715 Broad St., Sewickley, Pa.
Swenson, Norman Robert, 221 4th St., East Northport, N. Y.
Taslitz, Norman, % A. E. Felt, 306 Highland Ave., Madison, Wis.
Webb, Patricia Fuller, 723 Linden Ave., Oak Park, Ill.
Westcott, Joy Nadine, Box 225, Soledad, Calif.
Wilds, Nancy Alexander, 3908 Chestnut St., Philadelphia 4, Pa.
Willard, Marion Joyce, Oxford Rd., Southport, Conn.
Zastrow, Grace Lorraine, Nashotah, Wis.

BOOK REVIEWS

The reviews here published have been prepared by competent authorities and do not necessarily represent the opinions of the American Congress of Physical Medicine and Rehabilitation.

PHYSICAL MEDICINE IN GENERAL PRACTICE. Edited by *William Bierman*, M.D., and *Sidney Licht*, M.D., with twenty-two contributors. Third edition. Cloth. Price, $12.50. Pp. 798, with illustrations. Paul B. Hoeber, Inc., Medical Book Department of Harper & Brothers, 49 East 33rd St., New York 16, 1952.

This third edition of Physical Medicine in General Practice, which has long been considered one of the standard reference texts, is edited by Dr. William Bierman and Dr. Sidney Licht and contains chapters written by 22 authorities in physical medicine and rehabilitation. Although this book follows the same general outline of organization as did previous editions, it actually represents a complete revision of the former editions. Outmoded material and techniques have been eliminated. Authoritative new chapters have been added to include such subjects as ultrasound, microwave diathermy, neuromuscular re-education, functional muscle testing, manipulation and the care of the amputee. Also many additional illustrations have been included.

This volume gives comprehensive coverage to modern concepts and newer developments in the field of physical medicine and rehabilitation. The chapter on ultrasound is a particularly well balanced approach to the clinical use of a new therapeutic agent. The chapter on occupational therapy, written by Dr. Licht who has ably devoted so much energy to the furtherance of this field, gives an excellent evaluation of its various forms and their practical applications. The chapter on medical rehabilitation also deserves special commendation for its concise yet comprehensive discussion of various phases of rehabilitation.

It is difficult to find any important section of this book to criticize since it is on the whole very well written and edited. However, a few minor points might be mentioned. In the discussion concerning heating of tissue that occurs in short wave diathermy, mention is made of "ohmic resistance" and "conductive" and "displacement" currents; it is this reviewer's impression that such terms are now obsolete and that it is better to speak of "tissue impedance" and "electromagnetic flux" when discussing the theory of heating with diathermy. Also electric and magnetic fields cannot be separated in such apparatus. One other point: in the chapter on Visible and Infrared Radiation the reader is left confused as to whether significant increase in blood flow could or could not occur upon exposure to infrared radiation.

This book definitely fills the present need for an up-to-date textbook in physical medicine and rehabilitation. It should be in the library of every physiatrist. In addition, many physicians in general practice and in various specialties will find it a valuable reference work.

THE STORY OF THE ADAPTATION SYNDROME. (Told in the Form of Informal, Illustrated Lectures.) By *Hans Selye*, M.D. Ph.D., (Prague), D.Sc. (McGill), F.R.S. (Canada). Professor and Director of the Institut de Medecine et de Chirurgie experimentales Universite de Montreal. Leather, $4.50. Pp. 225, with illustrations. ACTA, Inc., 5465 Decarie Blvd., Montreal 29, Que., Canada, 1952.

There are many among us who after diligent effort to master the impressive content of Selye's recent monograph, "STRESS," had felt the need for some informal but official commentary through which to grasp its kaleidoscopic implication. The many who recognized the highly specialized quality of its formal discourse had frequently manifested their personal desires to the author during his lectures for some extracurricular text, to more readily increase their orientation of his general adaptation concept in relation to its clinical import.

The title of the book gives it the character of its discussion. It relates the story of the adaptation syndrome within the frame of biographic incidences as developed from direct contact with diverse groups of medical students, physicians and laboratory experiences during his lectures in Europe and in the Americas as compiled from edited wire-recordings. These unprepared and spontaneous discussions proved more stimulating according to Selye's observation "than my laboriously compiled, extensive monographs, which attempted to present the entire relevant literature in a systematic manner." Thus this volume is not altogether a summary of past conclusions but an extension of its thesis through the intimate channels of personal experiences, leading to the clearer understanding of its universal biologic implications. In the space of seven lectures the author carries the reader through nearly two decades of continuous experiences of the gradual evolution of a brilliant concept of the nature of biologic stress and the dynamics of the adaptive syndrome as it is realistically evaluated under the most exact laboratory tests, resulting in one of the most profound hypotheses contributed to modern medicine. As Selye puts it, it proves that "the great problem of endocrine physiology is no longer what the hormones do, but what adaptive reaction they influence." Similarly, endocrine pathology "is no longer what or which disease is caused by excessive function or destruction of an endocrine gland, but in which disease has the endocrine status a decisive influence." Finally there emerges from this concise and provocative exposition a literary contribution, exemplary for its rhetorical beauty and subtle humor, the Keystone conclusion being that the main object of this study is no longer the problem of individual "pathogens," but rather pathogenic situations under stress of some 25 etiologic biophysical, physiologic and chemical factors under a flexible destiny of the biologic adaptation syndrome.

ADMINISTRATIVE MEDICINE. *Haven Emerson,* A.M., M.D., Editor. Cloth. Price, $10.00. Pp. 1007. Thomas Nelson & Sons, 19 E. 47th St., New York 17; Parkside Works, Dalkeith Road, Edinburgh 9, 1951.

The editor of Administrative Medicine points out in the introduction that many persons are familiar with the objects, methods, organization and results of some medical administration with which they are connected in an employed capacity; that they also come into personal relation with one or many of the voluntary or governmental agencies of medical service each year whether they seek personal care in sickness or receive in a direct or remote way some protection from the local or state department of health.

Few physicians or representatives of the laity are, however, even superficially acquainted with the wide scope, varied character and close interrelationship of the many public facilities for organized care of the sick and for public health. It is primarily to bring to physicians a more precise description of the functions and organization of these institutions and agencies that persons of experience and authority in the various special fields of administrative medicine have collaborated as authors for this volume.

The scope of administrative medicine falls under two broad subdivisions: organized care of the sick and public health. The term organized care of the sick is defined by listing the following special functions: Hospital care for bed patients; out-patient care for the ambulatory sick; convalescent homes to complete recovery; care of the chronically ill; visiting nurse service for the sick at home; medical social service; home medical care; rehabilitation. A precise definition of public health as a community service is given as "the application of the sciences of preventive medicine through civil government for social ends."

The book is divided into four parts, contributed by fifty-eight authors and contains 1007 pages. Part I presents the development of organized care of the sick in its chronologic sequence from its original and still most important function of general hospital care of bed patients; the special purpose institutions for the communicable diseases, tuberculosis, mental and other chronic diseases are described with appropriate detail; the needs of the convalescent patient, home nursing and medical care under professional supervision, development of social service with an added chapter on rehabilitation, recognized as a third phase of medical care. In Part II services for the sick by the federal government as a civilian and military agent of the people and by institutions of higher education are described, and chapters on voluntary prepayment plans for medical care and some of the basic principles of medical economics are presented. Part III deals with the structural authority and organization of public health services from the basic local government unit through states and provinces and among the nations to the international development but recently consummated in the World Health Organization. Part IV is devoted to a somewhat detailed description of the great variety of functions included within the scope of contemporary public health performance in the United States.

This book is well organized and very readable, presenting much detail on administrative medicine, with which many doctors are not well acquainted. This book certainly belongs in every medical library.

THE KNEE AND RELATED STRUCTURES: INJURIES — DEFORMITIES — DISEASES — DISABILITIES. By *Philip Lewin,* M.D., F.A.C.S., F.I.C.S. Professor and Chairman of Department of Bone and Joint Surgery, Northwestern University Medical School; Attending Orthopedic Surgeons, Cook County Hospital; Senior Attending Orthopedic Surgeon, Michael Reese Hospital; Professor of Orthopedic Surgery, Cook County Graduate School of Medicine, Chicago; Formerly Colonel, Medical Corps, A. U. S. Cloth. Price, $16.00. Pp. 914, with 33 illustrations and 2 colored plates. Lea & Febiger, 6000 S. Washington Sq., Philadelphia 6, 1952.

In this excellent text no effort is spared in making available to the reader all aspects of medicine as relates to the knee, including anatomy, physiology, pathology and clinical diagnosis, x-ray changes, methods of treatment both conservative and surgical, and prognosis. It is based on the author's extensive experience and reports from the literature. The book is profusely and well illustrated, attractively bound and printed, and authoritatively documented by an extensive bibliography. The approach is somewhat didactic, including many charts and "rules of thumb" so popular for teaching purposes. The emphasis is on clinical description and diagnosis, including conservative treatment, rather than on details of operative procedures. Physical Medicine is not omitted, although the term does not appear in the index, whereas the rather outdated term phototherapy does; on the other hand, special mention is made of progressive resistance exercises, although they are not noted in the index.

This is certainly a text the orthopedist and physiatrist will wish to have available for easy reference in his library. It is suggested that for future editions a physiatrist be consulted to edit references to physical medicine in treatment of knee conditions; that the index be enlarged considerably, since this is essentially a reference text; and that the bibliography either contain direct references to the text or be grouped according to subject matter.

TEXTBOOK OF ENDOCRINOLOGY. By *Hans Selye*, M.D., Ph.D. (Prague), D.Sc. (McGill), F.R.S. (Cañada), Professor and Director of the Institut de Medecine et de Chirurgie experimentales Universite de Montreal. Second Edition. Fabrikoid. Price, $13.50. Pp. 914, with illustrations. Acta Endocrinologica, Inc., 5465 Decarie Blvd., Montreal 29, Que., Canada, 1950.

The popularity of this text of endocrinology is attested to by this the fourth printing (1950) of the second edition (1949). Once again the text represents the best as a standard textbook of vertebrate endocrinology. It consists of twelve chapters, covering the more important and established facts of all branches of the science of endocrinology. It is a well written, concise, well balanced exposition containing many excellent illustrations. In this the second edition, in addition to the inclusion of new and important key references and more suitable illustrations, the section "Commercial Hormone Preparations" has been rewritten. The publishing is excellent and the text is highly recommended for use by medical students and physicians as well as specialists.

MY FIGHT TO CONQUER MULTIPLE SCLEROSIS. By *Hinton D. Jonez*, M.D., as told to Miriam Zeller Gross. Cloth. Price, $3.50. Pp. 227. Julian Messner, Inc., 8 West 40th St., New York 18, 1952.

This is a fascinating and absorbing story of Doctor Jonez' five year fight against Multiple Sclerosis, waged at the Multiple Sclerosis Clinic of St. Joseph Hospital, Tacoma, Washington. Participating in this fight were the Sisters of St. Francis, along with nearly two thousand men and women seeking relief from the ravages of this disease. Doctor Jonez states that most of these people have recovered sufficiently to live normal lives and practically all have lost their fear of multiple sclerosis. Doctor Jonez got his inspiration from Bayard T. Horton of the Mayo Clinic and the late Foster Kennedy, professor of neurology at Cornell University Medical College. Both of these men stated they believed multiple sclerosis could well be explained on the basis of allergy. Doctor Horton instead of using antihistaminics did just the opposite, he used histamine. The treatment at St. Joseph Hospital has been referred to as the "total push." It includes histamine — intravenous injections and ion transfer once the patient leaves the clinic so that treatment can be continued at home — curare, control of allergic manifestations, physiotherapy and psychotherapy (better known, states the author, as T. L. C., or tender loving care). This book is written for the layman and gives the story of the patients who came to the clinic, their condition before and after treatment. August 15, 1952, a new $200,000 clinic was to be opened as the St. Joseph Hospital Clinic for Demyelinating Diseases which is quite a step from its humble beginnings. Dr. Jonez is certainly an unusually sincere and dedicated man and if history vindicates his thesis and results, he will have made a contribution to medical science of inestimable value.

Every general practitioner should read this story even though it is written in a popular style. This does not detract from the actual facts presented nor obviate the medical opposition he encountered. On request the publishers included an excellent presentation on Multiple Sclerosis delivered by Doctor Jonez before the 36th Annual Meeting of the Interstate Postgraduate Medical Association of North America at St. Louis, October, 1951. This book is highly recommended.

MEN, WOMEN, AND MORALS. By *Sylvanus M. Duvall*, Professor of Social Science and Religion, George Williams College. Cloth. Price, $3.75. Pp. 336. Association Press, 291 Broadway, New York 7, 1952.

The author bases this book on the conviction that people have a right to sound guidance regarding sex conduct and standards, based upon the best scientific knowledge and deepest insights available. The book is concerned primarily with sexual morality. The study is presented in four sections comprising sixteen chapters. Section one, is entitled "Where are we now?" with three chapters as follows: the old order changeth—it is time to take stock; what has happened; and the scientific approach to sex morals. Section two is entitled "How sex conduct affects people," with a chapter given to the physical results, psychological effects, and the social results of sexual intercourse. Section three discusses sex morality in specific situations. Section four is entitled "Sex morality in larger contexts." The volume closes with an appendix which includes "A Manifesto on sex standards, a summary, a bibliography and the usual subject index as well as an author's index. This is an admirably written book for the educator, the religious leader and layman. It is well written and should find a ready audience. This book is highly recommended to those who have become confused with the changing morality of our rapidly moving period.

KINESIOLOGY IN NURSING: LABORATORY MANUAL. By *Bernice Fash*, M.A., University of Illinois, Cook County School of Nursing. McGraw-Hill Series in Nursing, Lucile Petry, Consulting Editor. First Edition. Paper. Price, $2.80. Pp. 142, with 102 illustrations by Paul H. Stone. McGraw-Hill Book Company, Inc., 330 W. 42nd St., New York 18; Aldwych House, Aldwych, London, W.C.2, 1952.

This laboratory manual covers material far too much advanced for nurses which, in the opinion of the reviewer, makes it somewhat impractical. It appears to have been written by a physical educator who has a very limited knowledge of nursing and its problems. It certainly does not appear to be the province of the nurse to make a muscle analysis of the patient and to prescribe exercise. These are both functions of the physiatrist, or, if he is not available, then the physical therapist, may fulfill this highly specialized function. It is sufficient to teach nurses good body mechanics for their own health and the proper use of their body so as to avoid strain and fatigue when attending the patient. The book does, however, have some practical value in illustrating the proper transportation and handling of bed patients. There are two parts: Part one gives a good set of rules applied to recumbency, rules applied to coordinated movement, and joint muscle function. Part two deals with kinesiology in nursing, discussing positions of recumbency, getting the patient out of bed, and crutch walking. A good bibliography is appended as well as an excellent list of visual aids. This manual will not fill the need of the nursing profession nearly as well as Winters "Protective Body Mechanics in Daily Life and in Nursing." Winters' book seems *to have grasped the real essentials probably be*cause she is both a nurse and physical therapist.

DISEASES OF THE EAR, NOSE AND THROAT. PRINCIPLES AND PRACTICE OF OTORHINOLARYNGOLOGY. CLINICAL TECHNIQUES AND PROCEDURES. By *Francis L. Lederer,* B.Sc., M.D., F.A.C.S., Professor and Head of the Department of Laryngology, Rhinology and Otology, University of Illinois College of Medicine, Chicago; Chief of the Otolaryngological Service, Research and Educational Hospital; Captain, Medical Corps, United States Naval Reserve; Director of Otolaryngology and Chief of the Ear, Nose and Throat Service, Illinois Eye and Ear-Infirmary. Sixth Edition. Fabrikoid. Price, $20.00. Pp. 1430, with 979 illustrations, 20 in color. F. A. Davis Company, 1914 Cherry St., Philadelphia 3, 1952.

It is indicated in the preface of this text that "The main purpose of this expanded work is to provide encyclopedic information in the specialty of otolaryngology." This purpose has certainly been achieved. The first four sections are devoted one each to the ear; the nose and paranasal sinuses; the mouth and pharynx; and the larynx trachea, bronchi, and esophagus. Each of these sections begins with a consideration of the anatomy physiology and method of examining the particular region discussed. There then follows a rather comprehensive consideration of the diseases of each of these regions. A fifth section entitled "General and Correlated Considerations" picks up the loose ends, so to speak, and considers diseases closely related to the field of otolaryngology. A few of the topics discussed in this section are neuralgia of the head and neck, allergy, enlargements of the head and neck, ophthalmological aspects, and the psychosomatic approach to otolaryngology. A chapter dealing with disorders of speech and voice will be of special interest to physiatrists concerned with rehabilitation problems in this field.

The format of the text is most attractive and it is deserving of special commendation for the 979 very excellent illustrations. The text is devoid of bibliographic material. It will be of value particularly to the medical student as a text book, but will also provide any physician with valuable information regarding the field of otolaryngology.

REHABILITATION NURSING. By *Alice B. Morrissey,* B.S., R.N. Instructor in Rehabilitation Nursing, New York University-Bellevue Medical Center; Supervisor of Nursing Service, Department of Physical Medicine and Rehabilitation, Bellevue Hospital. Cloth. Price, $5.00. Pp. 299, with illustrations. G. P. Putnam's Sons, 210 Madison Avenue, New York, 1951.

The purpose of this volume is to emphasize the modern concepts of a nursing service in a rehabilitation center. The author is eminently well qualified to write concerning this subject since she has been associated with one of the largest and best equipped rehabilitation centers in this country, working under the leadership of Dr. Howard A. Rusk and Dr. George G. Deaver. The *book is divided into three sections: (1) The* Meaning of Rehabilitation, which includes an excellent and brief historical survey, cites figures concerning the incidence of various disabilities and discusses the nurse's role in rehabilitation; (2) Nursing Principles and Procedures in Rehabilitation, which contains valuable information concerning prevention of deformities and decubital ulcer, training of bowel and bladder in paraplegics and teaching the activities of daily living; and (3) Nursing Practice in Rehabilitation, which discusses general nursing care of patients with the more common disabilities. Although the author has intended this volume primarily for nurses and nursing students, it is also recommended to all physicians who treat patients with rehabilitation problems, to physical therapists and occupational therapists and students in these fields, and even to selected lay people, who might profit by better understanding of nursing problems in management of such patients. This volume is clearly written and carefully edited; its illustrations are well chosen and reproduced. The author should be commended for presenting so readably the contributions that nurses can make in working with the physician toward the rehabilitation of the disabled.

INJURY OF THE XIPHOID. By *Michael Burman,* M.D., and *Samuel E. Sinberg,* M.D. Cloth. Price, $3.50. Pp. 92, with illustrations. Columbia University Press, 2960 Broadway, New York 27, 1952.

The xiphoid, called the "inhospitable host," is responsible for various symptoms and signs many of which are attributed to other structures. Even the absence of the xiphoid, or axiphoidea, has clinical significance, whereas a large xiphoid is a "sign of masculinity." "Xiphoidalgia" may be a primary or a secondary disease and reasons and examples are given. Direct trauma to this structure, particularly frequent today due to steering wheel injuries, and need for its removal, are discussed at some length. This small monograph by calling attention to the lowly xiphoid as a possible cause of various disorders has a justifiable purpose.

TREATMENT BY MANIPULATION. By *H. Jackson Burrows*, M.D., F.R.C.S., F.R.A.C.S., Orthopedic Surgeon, St. Bartholomew's Hospital, London, and *W. D. Coltart*, M.B., F.R.C.S., Assistant Orthopedic Surgeon, St. Bartholomew's Hospital. Second Edition. Cloth. Price, 12s. 6d. Pp. 80, with 29 illustrations. Published on behalf of "Practitioner," 5 Bentinck St., London, W.1, by Eyre & Spottiswoode, 15 Bedford St., Strand, London, W.C.2, 1951.

This is the second edition of a work that first appeared eleven years ago. The original plates were destroyed during the war, so that this edition contains new type and illustrations.

Manipulation, according to the authors, is the "forcible movements which may be used at a single sitting" usually given under the effect of some types of anesthetic, and is not the passive movements as given by the physical therapist. The importance of the correct diagnosis, which is aided in most instances by a thorough physical and roentgen examination, is stressed. The various parts are presented with a brief description of the technique of the manipulation. The illustrations bring out the maneuver better than the printed text. This small volume makes no attempt to delve into the rationale of the methods; it gives merely the techniques as practiced by two skillful orthopedists.

Undoubtedly manipulation when done by competent and experienced physicians has its place in therapy, particularly in the field of physical medicine. The preface of the book contains these remarks: "The profession has been charged with neglecting manipulative treatment and with dwelling on the disasters of the 'bonesetter' rather than upon his known successes. It may be that many members of the medical profession know too little of the selection of cases for manipulation, its technique and the results which may be expected from it."

THE HYPERSENSITIVE MIND IN NORMALS, NEUROTICS, PSYCHOPATHS AND PSYCHOTICS: Prevention and Treatment. By *Gabriel Langfeldt*, M.D., Professor of Medicine, Oslo, Norway. Acta psychiatrica et neurologica scandinavica, supp. 73. Paper. D.Kr. 20.00. Pp. 147. Ejnar Munksgaards Forlag, Norregade 6, Copenhagen, K, 1951.

This treatise develops the author's theory of the "hereditary-conditioned" factors and their reaction on the normal, psychoneurotic and psychotic individuals. He is particularly interested in the shy, timid child and the effect of various external forces. Numerous case reports are included to illustrate his ideas.

This reviewer believes the author raises a pertinent point concerning the development of neurotic reactions, applicable particularly in the U. S. A., which he explains as follows — "the steadily increasing taxation pressure . . . . brings about a tendency even in the people of otherwise high morals to deceive the authorities in respect to their incomes." He suggests "some amelioration of the social irritative forces will be necessary." Unfortunately not one politician will read these lines!

THE SCALP IN HEALTH AND DISEASE. By *Howard T. Behrman*, A.B., M.D., Assistant Clinical Professor of Dermatology, New York University Post-Graduate Medical School; Adjunct Dermatologist, Mount Sinai Hospital; Attending Dermatologist, Hillside Psychiatric Institute; Formerly Associate Dermatologist, Bellevue Hospital, and Assistant Attending Dermatologist, University Hospital; Fellow in Dermatology, New York Academy of Medicine; Member, Committee on Cosmetics, American Medical Association; Society of Cosmetic Chemists; Society for Investigative Dermatology; Fellow, American Academy of Dermatology; Diplomate, American Board of Dermatology. Cloth. Price, $12.75. Pp. 566, with 312 illustrations. The C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, Mo., 1952.

There are few cutaneous diseases which do not at one time or another affect the scalp, and it is the mirror for many systemic diseases. From the cosmetic standpoint hair is expensive; millions are spent on hair and scalp care each year. There are hundreds of pseudoscientific organizations that prey on the public throughout the United States by advertising half-truths about scalp diseases. A sizable part of the practices of the general physicians and dermatologists consists of advising patients who, because of oily scalp and/or faces that feel "dry and tight," or an increasing scaliness of the scalp, find that oil treatments, pomades and creams for such conditions as "dry" skin, oily skin or medium dry and oily skin, merely serve to aggravate the condition; because neither the patients nor cosmetologists understand the paradoxical paresthesia of seborrhea. In this volume the author has collected and condensed a wealth of material on embryology, anatomy, anthropology, physiology and chemistry of the hair. In one section, the care of normal hair and scalp and the uses and dangers of various preparations and dyes are discussed. In the chapter on the alopecias, interesting opinions of the various theories of baldness are presented along with diagrams of the types of baldness. Peculiarly, women can also have a certain degree of male-type baldness. A chapter is devoted to the seborrheic diathesis. Chapters are concerned with infections of the scalp including bacterial, viral, fungous, parasitic, spirochetal infections and infestations. Discussions of scalp involvement from cutaneous, systemic and neoplastic diseases comprise other sections. Psychogenic scalp disorders of proved or presumptive origin are also considered. The clinical and histologic aspects, differential diagnosis, and etiology of the conditions are discussed together with treatment from both the systemic and local standpoints. Included are formulas for many scalp and hair preparations. The appendix includes an extensive therapeutic formulary. There is a comprehensive index. In this encyclopedic volume the author has gathered extensive scientific information concerning the hair and scalp from numerous dispersed sources and brought it up to date. The volume will be useful to students, dermatologists, general physicians, and others who are interested in this phase of dermatology.

THE ELECTRICAL IMPEDANCE OF A COMPLEX TISSUE AND ITS RELATION TO CHANGES IN VOLUME AND FLUID DISTRIBUTION: A STUDY ON RAT KIDNEYS.

By *Borje Lofgren.* Acta Physiologica Scandinavica, Vol. 23, Supplementum 81. Paper. Pp. 51, with 12 Illustrations. Almquist & Wiksells Boktryckeri AB, Uppsala, Sweden, 1951.

The author discusses the theory and technique of impedance measurements in living organs and shows how the application of this method enabled him to follow changes of volume in the living rat kidney. Strong solutions of histamine caused an increase in kidney volume, whereas strong solutions of acetylcholine caused a decrease sometimes followed by an increase. Epinephrine caused a decrease in kidney volume.

The subject of electrical impedance is fundamental in physical medicine but impossible to understand without considerable knowledge of double algebra and alternating currents. The author leaves no doubt as to his own command of the subject but his introductory statements are unclear and his diagrams, with the Y-axis pointing down instead of up, are confusing. The difficulties likely to be encountered by the novice trying to read an article of this kind cannot all be anticipated; the best way to discover them is to take a group of students through the subject in detail. In such a review, the semantic traps lurking behind phrases like "complex tissue" and "complex plane" or "phase angle" and "diphasic system" could be brought to light; and unresolved difficulties, which sometimes accumulate as the reader progresses until he bogs down under them, could be removed. Aside from this trouble, which is largely inherent in the abstruse subject, the book must be commended as a substantial and scholarly contribution to biophysics.

FRONTAL LOBOTOMY AND AFFECTIVE BEHAVIOR: A NEUROPHYSIOLOGICAL ANALYSIS.

By *John F. Fulton,* M.D., Sterling Professor of Physiology, Yale University, New Haven. (Thomas William Salmon memorial lecture.) Cloth. Price, $3.00. Pp. 159, with 21 illustrations. W. W. Norton & Company, Inc., 101 Fifth Ave., New York 3, 1951.

This is one of a series of lectures given annually under the auspices of the New York Academy of Medicine to honor the memory of Dr. Thomas William Salmon, whose influence for the better treatment and prevention of mental disorders was extraordinary and world wide. The understanding, loyalty, and esteem of his colleagues are expressed in these series of memorial lectures that advance the causes of which he was a valiant pioneer.

While Fulton is a physiologist, it would have been most difficult to select a man more able to lecture in this continually changing and rapidly developing field of psychiatry. Dr. Fulton reviews work undertaken since 1948 by his staff and associates at Yale. Attention was devoted to behavioral problems in primates with especial attention to the anatomical and physiological background of the operation of lobotomy and frontal gyrectomy. He also reviews a number of the many clinical reports on lobotomy, which will be of marked interest to every clinician. The book is divided into four chapters. Chapter one discusses the historical background from the psychobiological approach. Chapter two discusses recent disclosures concerning the functional anatomy of the fronto-cingulo-temporal cortex. The author in chapter three gives an account of the newer behavioral studies carried out in monkeys, baboons, and chimpanzees. The final chapter is devoted to the broad theme of frontal lobotomy in relation to man.

The book is well written, easily read, and will be a most valuable addition to the library of every clinician. While Dr. Fulton surveys the frontiers of this fascinating field he never leads one beyond the depths of clinical understanding. This small volume is highly recommended.

ENDOCRINE DIAGNOSIS.

By *H. Ucko,* M.D. Cloth. Price, $8.50. Pp. 513, with 84 illustrations. Staples Press, Ltd., 70 E. 45th St., New York 17; Staples House, 83 Great Titchfield St., London, W.1, 1951.

The author has divided his book into two parts. The first part consists of the differential diagnosis of endocrine symptoms and signs as related to the various body systems and geographic areas. The second part deals with specific diseases of the various endocrine glands.

The first part of the book is very clearly outlined and should be of definite help to the general practitioner and general internist in differentiating normal physiologic variations from endocrine disease. Especially well-covered is the normal physiologic endocrine changes which occur during development from infancy to adulthood and how they may be differentiated from endocrine disease. Of less value is the attempt to associate symptoms occurring in various parts of the body with certain types of endocrine disease. Physiologic disturbances that occur in the various systems in the presence of the different endocrine diseases are thoroughly and clearly outlined by the author, for example, the causes of osteoporosis and the causes of pigmentation. It is good to see the author make the point that obesity is not endocrine in origin. Part two of the book, which deals with the diseases of the endocrine glands, is very sketchily covered and will not be nearly so valuable to the general practitioner and general internist as is part one.

This book is recommended because of the excellent outline report on the differential diagnosis of endocrine symptoms and signs from nonendocrine disturbances. It is not nearly so valuable for discussion of diseases of the endocrine glands as are several other modern texts which cover this much more adequately.

PHYSICAL MEDICINE ABSTRACTS

Pole Top and Other Manual Resuscitation Methods: A Comparison Study. Archer S. Gordon; Max S. Sadove; Frank Raymon, and A. C. Ivy.

Indust. Med. 21:147 (April) 1952.

Comparative tests of pole top and manual resuscitation techniques, as carried out on normal adults curarized-anesthetized to total apnea, confirm the finding that push-pull methods are two to three times as efficient, as regards pulmonary ventilation, as either the push or the pull only methods. For general purposes the arm-lift back-pressure, (back-pressure *arm-lift*), *modified from* the Danish Nielsen method, should be used, since it is easy to teach, can be performed by most operators for prolonged periods of time, and gives excellent pulmonary ventilation without circulatory embarrassment. Trained personnel should also be acquainted with the hip-lift back-pressure and Silvester arm-lift chest-pressure methods to be used as ready alternatives in special circumstances.

The pole top method of resuscitation gives adequate ventilation, and should be instituted immediately in cases where linemen are shocked on the poles. However, since the vertical position predisposes to peripheral stasis and circulatory embarrassment, as well as impeding the drainage of fluids which may collect in the oropharynx, the victim should be lowered to the ground as soon as practical. The pole top method should be continued during the descent, and one of the more efficient push-pull methods begun as soon as he can be placed in the prone position.

Neurosurgical Aspects of Spinal Cord Injury. Edmund A. Smolik.

Mississippi Valley M. J. 74:38 (Mar.) 1952.

Spinal injuries in their neurosurgical aspects can be considered from various viewpoints. For simplicity, a classification based on anatomical derangement may be useful. In this category belong: (1) a. Cervical Neuritis; b. Cephalgia of Neuritic (Cervical) Origin; (2) Cervical Arthritis (Osteophytes); (3) Intervertebral Disc Rupture; and (4) Vertebral Fracture. Ideally, the patient should be hospitalized at rehabilitation centers. Here, the entire individual and problem become a matter of coordination in which the physical therapist, the trained nurse, the neurological surgeon, the neurologist, the psychiatrist, social service worker and the orthopedic surgeon work as an integrated team. Rehabilitation should be not only somatic but also psychic. Permanent braces, stimulation by early ambulation and physical therapy, as well as recreational activities, in the form of group therapy, are worth more than any isolated, operative maneuver.

Chronic Low Backache. F. X. Krynicki.

Indust. Med. 21:111 (Mar.) 1952.

Patients with a chronic low backache often experience an acute exacerbation of pain within five to fourteen days after wearing especially reinforced and corrected shoes. In the presence of greater irritative changes, intravenous procaine, heat, massage, and various oral and parenteral medications are employed in addition. The treatment is used regardless of the duration of the backache. If, however, after two weeks little progress is made, the next step is taken. To begin with, it is necessary to lessen or eliminate spasm which accompanies pain, and it has been found that bilateral, discontinuous traction of the partly flexed extremities is most suitable for this purpose. No traction is used at night and the usual anodynes are given the patient in the early stages of treatment. After the first two days, or when improvement seems apparent, the patient is given special shoes, which he is obliged to wear whenever he is up and about. After traction, the patient is observed for five days or a week, during which time he is given physical or medical treatment as mentioned above. If painful symptoms do not lessen, traction is reapplied for a second or a third time as indicated. Physical and medical treatment is continued for about six to twelve weeks, although some patients require less or more attention. When patients are refractive to an absolute degree in the first two to three weeks, and are definite about their condition, little of a conservative nature can be done for them.

Ultrasound and Industrial Medicine. Horace O. Parrack.

Indust. Med. 21:156 (April) 1952.

Ultrasound equipment is being used more and more extensively in industrial situations. It is used to detect flaws in materials, to determine certain properties of materials, to secure dispersion of solids in liquids (emulsion), for agglomeration of particles from liquids and gases, and many other jobs.

Ultrasound is being extensively used in biology and medicine, where its application may be classified under two general headings: (1) experimental studies using ultrasound, and (2) therapeutic methods utilizing ultrasound. The literature in these biological fields is already extensive, and more work is being undertaken daily.

The experimental studies in which ultrasound is employed usually have one of the following purposes: (1) determination of the physical properties of the tissue studied; (2) determination of the mechanisms by which ultrasonic energy produces an effect on biological material; (3) determination of the effect of ultrasound on physiological functions of tissue; (4) evaluation of the usual function of the tissue area destroyed, or rendered nonfunctional, ultrasound being used as a tool to perform localized injury or destruction of tissue for this purpose.

Because various tissues and body structures have different capacities for reflecting or absorbing ultrasound it may be possible to utilize these effects in localizing or determining the dimensions of these structures. Foreign bodies or crystal secretions occurring in some part of the body may possibly be located by the application of ultrasonic waves. These applications are essentially diagnostic.

Ultrasonic energy also has been used for various therapeutic purposes, the most of these applications having been made in Germany. There still is much uncertainty as to its effectiveness. Certainly much caution should be exercised in therapeutic applications until it is established: (1) that ultrasound is an effective agent, and (2) that it can be applied in such a manner that it will not produce unexpected damage.

The question of the damaging action of airborne ultrasonics is discussed, and it is concluded that there is *no hazard.* It is pointed out that a probable hazard exists, and that this will increase as the use of ultrasonic generators increases. However, the authors conclude that control of these hazards should be a relatively easy task.

The Role of Physical Medicine and Rehabilitation in a Large Neuropsychiatric Hospital. Daniel Dancik.

J. A. M. A. 148:921 (Mar. 15) 1952.

A physical medicine and rehabilitation service in a neuropsychiatric hospital, with its psychological orientation, its recognition of the importance of socially integrating the patient into the hospital milieu, and its goal of integrating all other therapeutic auxiliaries in the hospital, when administered by a psychiatrist specially trained in its application, is one answer to the problem of the ever-increasing patient population. Physical medicine and rehabilitation, in addition to its value as supportive treatment for a large number of early psychotics who respond favorably to other accepted psychotherapeutic modalities, provides the best means of therapy for those who do not respond to these measures. Karl Menninger has aptly stated that the neuropsychiatric patient invariably cannot work or play. Therefore, to teach such a patient how to work and how to play is to teach him how to adjust. Physical medicine and rehabilitation must try to make it possible for the patient to find an outlet for his instinctual urges in work and play. The physical medicine and rehabilitation service, as presently constituted at the Northport Hospital, consists of five specialized therapy segments, namely, occupational therapy, manual arts therapy, corrective therapy, physical therapy and educational therapy. This service is staffed by psychiatrically oriented therapists and is guided by a psychiatrist who is physiatrically inclined. Corrective therapy provides physical reconditioning activities for the purpose of offsetting advance of physiological retrogression during the regressive and deteriorative phases of chronic psychosis. It is directed toward the restoration of full strength and stamina through participation in progressively graded physical activities.

Physical therapy in a large neuropsychiatric hospital finds many fruitful applications. Hydrotherapy at the Northport Hospital is psychiatrically and physiatrically oriented to the extent of being medically controlled instead of being a simple nursing procedure. It is used for treatment purposes only, is carefully observed and controlled, and the feeling of punishment is removed and restraining factors lessened by the proper training and guidance of the hydrotherapy aides. Physical therapy procedures have been found successful not only in treatment of the commoner physical disabilities but also in the treatment of functional peripheral vascular disorders resulting from hypostasis. Physical therapy is used at Northport to alleviate or prevent any physical disability. For the institutional psychiatrist who finds himself overwhelmed by the responsibilities of care of a large number of patients, a physical medicine and rehabilitation service provides a laboratory where patients exposed to the modalities of such a program can be carefully observed. It is also believed that a physical medicine and rehabilitation service in a neuropsychiatric hospital will assist in changing the ordinary conception of a psychiatric institution to one in which it is realized that "each individual patient will acquire habits and skills that will contribute to his social and economic integration."

Arthritic Deformities of the Wrist and Fingers. Arthur Steindler.

J. Bone & Joint Surg. 33-A:849 (Oct.) 1951.

Under the stimulus of the newer and dramatic remedies for rheumatoid arthritis, one may be confident that the general treatment of this disease is no longer neglected. But their effect, whether they be blood transfusion, the gold treatment, or the adreno-pituitary hormones, depends entirely upon the reversibility of the disease. Furthermore, it has not been proved that even the most potent of these hormonal remedies makes the local treatment dispensable in any phase of the arthritis. On the contrary, under the protection of the general treatment, conservative local measures have become more efficient and promising. The methods are well known: physical therapy, application of heat, paraffin baths, splinting, manipulative correction, active exercises, and much the same policy of reeducation as applies to other localized forms of arthritis. All these remedies have their proper place and their proper time, and it requires good judgment and understanding to allocate them properly and with profit to the patient. The paraffin baths and whirlpool baths are the most effective means in the stage of swelling and pain and before the development of actual contractures. Splinting also occupies an important place. It is indicated in the beginning stages of contracture. In certain cases in which swelling and pain occur spasmodically and in exacerbation, the result of splinting is sometimes striking. If contractures do not yield to traction, is it permissible to apply manipulation? We reject forcible manipulation on general principles, both for the wrist and for the fingers. They cause intra-articular hemorrhages, adhesions, and subsequent shrinkage of the capsule. Even passive stretching should never be carried to the point where tenderness or tear of the capsule develops. Stretching *should always be gentle, and one* should be sure that the connective tissues are not strained beyond their natural elasticity. It is the author's belief that gentle passive motion and physical therapy accomplish a great deal more than manipulation; an occasional successful case cannot be used as an argument for the latter.

A Method for the Objective Evaluation of Physical and Drug Therapy in the Rehabilitation of the Hemiplegic Patient. Seymour H. Rinzler; Henry Brown, and Joseph G. Benton.

Am. Heart J. 42:710 (Nov.) 1951.

The use of physical therapy and rehabilitation measures in the treatment of hemiplegia seems well established, but objective measurements of the results have been in qualitative rather than quantitative terms. As Dinken has indicated, such objective measurements should include "determination of muscle strength, range of joint motion and functional testing of the factors inherent in daily living." The value of a new therapeutic approach in the management of hemiplegia can be assessed only by its ability to shorten the time-course of rehabilitation, such effects, if any, being rigidly compared with those obtained in adequate controls. The time-course of rehabilitation may be defined as the shortest interval in days between the onset of treatment and the greatest retained achievement in range of joint motion, muscle strength, and performance of tasks of daily living. This report describes an objective technique, established to study the effect of physical therapy and rehabilitation techniques on the time-course of rehabilitation in the subject with hemiplegia as the result of a cerebrovascular accident. In addition, it can be used to screen the effects of drugs on this clinical entity. There is great need for such a method at the present time. Patients selected for study are placed on the regular program of physical therapy and rehabilitation advocated by Rusk and his group, which includes active and passive motion of the affected extremities, ambulation, speech training for the aphasic individual, and the teaching of the activities of daily living, such as personal care, feeding, hand activities, and walking activities. The rehabilitation program for each patient is prescribed by Rehabilitation Service physicians according to individual requirements. Serial determinations are made of all three modalities by experienced physical therapists at regular intervals during the course of therapy and observation, and the results are documented. In addition, observations by the physician of the effects of drugs on blood pressure, pulse rate, electrocardiogram, side reactions, and changes, if any, on hemogram and urine are made. Data derived by this method are quantitative and lend themselves readily to statistical analysis.

Autonomic Studies in the Diagnosis of Peripheral Nerve Lesions. Francis P. Nash.

Missouri M. A. 49:116 (Feb.) 1952.

Peripheral nerve injuries are frequent complications of battle wounds of the extremities. Such injuries often are associated with bony fractures and extensive soft tissue damage. These associated injuries diminish the reliability of motor and sensory studies in the detection of any existent nerve lesions. This report lends emphasis to the value of the study of peripheral sweat patterns and skin temperature in the diagnosis of peripheral nerve lesions. Such studies are of special value in cases in which associated injury alters the reliability of motor and sensory studies.

Frostbite. Agnes Spock-Ward.

Am. J. Nursing 52:68 (Jan.) 1952.

In cases of frostbite, along with the usual medical procedures, the patient does therapeutic exercises daily to prevent stiffness of affected parts, to prevent contractures, to increase blood circulation and flexibility, to maintain muscle tone, and to improve his morale. The exercises are active and active assistive. They commence at the same time as the patient's other treatments or as soon after he is admitted to the hospital as a therapist can see him. The chief medical officer of the cold injury section at the Osaka Army Hospital in Japan made this a "blank order," which could be altered only when exercises were contraindicated for reasons other than frostbite. When the hands are frostbitten, exercise with a rubber sponge may be used to prevent contraction, and to increase the strength of the hand. If the physical therapist is unable to visit each patient daily, it is the nurse's responsibility to see that each one performs the prescribed exercises.

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SUBJECT INDEX

This is an index of all the reading matter in the ARCHIVES, except the Medical News Department.

The letters used to explain in which department the matter indexed appears are as follows: "E," Editorial; "ab," abstracts; the asterisk (*) indicates an original article in the ARCHIVES.

This is a subject index and one should, therefore, look for the subject word, with the following exceptions: "Book Reviews" and "Deaths," are indexed under these titles at the end of the letters "B" and "D." The name of the author, in brackets, follows the subject entry. If there are more than two authors, only the name of the first author is given.

For author index, see page 757.

A

ACNE: Treatment of, [Goldman] 51—ab
ACTIVITY: Physical, Effect of Prognosis of Poliomyelitis, [Albrecht & Frances Locke] 431—ab
ADENOIDECTOMY: Indications for, [Frances Lederer] 170—ab
AEROSOL: Oxygen-Rich, Administration of, [Denton & Schaeffer] *727
AMBULATION: Late and Early, [Todd & Massie] 503—ab
AMPUTATION: Above-Knee, Adapted Wheelchair for, [Akwa & others] *156
  Rehabilitation of Amputee [Thomas] *357
ANKLE: Joint, Arthrodesis of, [Mead] 49—ab
APPARATUS: Treatment of Fractures of Femur, [Spittler & Brennan] 169—ab
ARTERIES: Peripheral, Diagnosis and Treatment of Chronic Occlusive Disease, [Barker] 54—ab
  Peripheral Insufficiency, Chronic, Diagnosis and Management, [Neu & Reedy] 306—ab
ARTHRITIS: Chronic, of Senescence, [Cecil] 118—ab
  Deformities of Wrist and Fingers, [Steindler] 747—ab
  of Spine, [Blodgett] 170—ab
  Orthopedic Management, [Carnesale & Garry] 634—ab; [Colonna] 52—ab
  Rheumatoid and Osteo, Nylon Arthroplasty in, [Kuhns & Potter] 308—ab
  Rheumatoid and Parkinsonism, [Wallerstein] 51—ab
  Rheumatoid, Chronic, [Smith] 697—ab
  Rheumatoid Patient, Effect of Contrast Baths on Vasomotor Response, [Fricke & Gersten] *210
ARTHRODESIS: of Ankle Joint, [Mead] 49—ab
AWARDS OF MERIT: 1952, Gold Key, 620; Scientific Exhibitors, 621

B

BACK: Braces, [von Werssowetz] *676
  Chronic Low Ache, [Krynicki] 746—ab
  Painful, [Bagnall] 53—ab
BANKART OPERATION: for Recurrent Shoulder Dislocation, [Rudd & Haydock] *353
BATHS: Contrast, Effect on Rheumatoid Arthritis Patients, [Fricke & Gersten] *210
BLOOD. Flow, Effects of Physical Therapies, [Randall & others] *73
  Ultrasonic Energy in, Mechanism of Absorption [Piersol & others] *327
BONE: Injuries, [Tobin] 501—ab
BRACES: Apparatus for Shoulder, [Wallace] *553
  Back, [von Werssowetz] *676
  for Rehabilitation, [Hoberman & Cicenia] 696—ab
BURNS: Local Treatment, [Curtis & others] 504—ab
BURSITIS: of Shoulder, [Witt & Titterington] 631—ab
  Treatment of Acute Subacromial, [Merliss] 633—ab

BOOK REVIEWS

Aged
  Physical Medicine and Rehabilitation for, [McClellan] 499
Aging
  Conference on, 626
  Conference on Problems, [Shock] 498
Allergy [Feinberg] 495
American National Red Cross, Mass Care in Disaster, 564
Anatomy, Primary, [Cates] 499
Appearance, and Mind, [Apton] 627
Apton, A. A., Your Mind and Appearance: A Psychological Approach to Plastic Surgery, 627
Ardis, J. A., A Synopsis of Neurology, 694
Armstrong, H. G., Principles and Practice of Aviation Medicine, 568
Arthritis, Rheumatoid, Care and Related Conditions, [Echtman] 241
Atomic Energy
  Biological Effects of External Beta Radiation, [Zirkle] 693
  Constructive Uses, [Rothmann] 499
Autobiography, [Margaret Stewart] 625
Aviation Medicine, Principles and Practice, [Armstrong] 568
Banks, S. W., editor, The American Academy of Orthopedic Surgeons Instructional Course Lectures, 496
Barron, E. S. G., Modern Trends in Physiology and Biochemistry, 568
Beaumont, G. E., Recent Advances in Medicine, 564
Behavior, Affective, Frontal Lobotomy, [Fulton] 745
  Cerebral Mechanisms in [Jeffress] 626
Behrman, H. T., The Scalp in Health and Disease, 744
Bevelander, G., Essentials of Histology, 566
Bickford, J. A. R., A Synopsis of Neurology, 694
Bierman, W., editor, Physical Medicine in General Practice, 740
Biochemistry, Advances in, [Nord] 692
  Human, [Kleiner] 304
  Physical, [Bull] 46

- Birnie, J. H., Hormones and Body Water, 498
- Blood Pressure, [Halperin] 47
  - Factors Regulating, [Zweifach & Shorr] 46
- Bortz, E. L., Diabetes Control, 114
- Boynton, Dorothy A., Posture and Pain, 500
- Brain, W. R., Diseases of the Nervous System, 693
- Brasset, E. A., A Doctor's Pilgrimage, 373
- Brazier, Mary A. B., The Electrical Activity of the Nervous System, 500
- Brooks, C. E. P., Climate in Everyday Life, 46
- Browd, V. L., The New Way to Better Hearing Re-Education, 565
- Brown, J. B., Plastic Surgery of the Nose, 304
- Brozek, J., The Biology of Human Starvation, 167
- Buchanan, A. R., Functional Neuro-Anatomy, 304
- Buchthal, F., and Kaiser, E., The Rheology of the Cross Striated Muscle Fibre, 629
- Buchwald, Edith, Physical Rehabilitation for Daily Living, 562
- Bull, H., Physical Biochemistry, 46
- Burman, M., Injury of the Xiphoid, 743
- Burrows, H. J., Treatment of Manipulation, 744
- Byrd, O. E., Health Instruction Yearbook 1951, 305
- Cash, Joan E., A Textbook of Medical Conditions for Physiotherapists, 305
- Cass, M. T., Speech Habilitation in Cerebral Palsy, 243
- Cates, H. A., Primary Anatomy, 499
- Cerebral Palsy, Speech Habilitation in, [Cass] 243
- Charlesworth, F., Chiropodial Orthopaedics, 627
- Chiropody, [Charlesworth] 627
- Climate, in Everyday Life, [Brooks] 46
- Coltart, W. D., Treatment of Manipulation, 744
- Conn, H. F., editor, Current Therapy 1952, 694
- Conwell, H. E., The Management of Fractures, Dislocations and Sprains, 168
- Covalt, D. A., Physical Rehabilitation for Daily Living, 562
- Cyriax, J., Textbook of Orthopaedic Medicine, 566
- Davson, H., A Textbook of General Physiology, 497
- Deaver, G. G., Physical Rehabilitation for Daily Living, 562
- Dermatology
  - Disorders, Therapy of, [Peck & Klein] 430
- Diabetes Control [Bortz] 114
- Diagnosis
  - Medical and Physical, [Loewenberg] 628
  - Medical, Applied Physical, [Pullen] 47
  - Physical and Medical, [Loewenberg] 628
  - Signs and Symptoms, [MacBryde] 630
- Disabled
  - in Modern World, 565
- Disease
  - and Human Health Problems, [Dublin] 692
  - of Nervous System, [Brain] 693
  - of Tropics [Shattuck] 114
- Dislocations
  - and Fractures, [Geckeler] 430
  - Congenital, of Hip, [Hass] 304
  - Management of, [Key & Conwell] 168
- Dispensatory of United States, 1950 [Osol & others] 114
- Doctor, Know Your, [Dorin] 497
  - Pioneer, [Moorman] 114
- Dodds, E. C., Recent Advances in Medicine, 564
- Dorin, D. M.. Patient's Doing Fine, Know Your Doctor and Your Hospital, 497
- Dublin, L. I., The Facts of Life from Birth to Death, 692
- Duvall, S. M., Men, Women and Morals, 742
- Ear, Diseases of, [Lederer] 743
- Eastern States Health Education Conference, 374
- Echtman, J., The Cure for Rheumatoid Arthritis and Related Conditions, 241
- Edsall, J. T., editor, Enzymes and Enzyme Systems, 167
- Education
  - Health, Psychological Dynamics, 374
- Eller, J. J., Tumors of the Skin, 693
- Eller, W. D., Tumors of the Skin, 693
- Emergencies, Cardiac, [Master & others] 627
- Emerson, H., editor, Administrative Medicine, 741
- Endocrinology, 1950 Yearbook, [Thompson] 167
  - Textbook of,]Selye] 742
  - Endocrine Diagnosis, [Ucko] 745
- Energy
  - Atomic, Constructive Uses, [Rothmann] 499
- Enzymes and Systems, [Edsall] 167
- Enzymology, Advances in, [Nord] 692
- Ethics, Medical, [Guenzel] 628
- Evans, G., Medical Treatment: Principles and Their Application, 167
- Face, Paralysis of, [Findlay] 47
- Farrar, G. E., Jr., The Dispensatory of the United States of America: 1950, 114
- Fash, Bernice, Kinesiology in Nursing: Laboratory Manual, 742
- Feinberg, S. M., Allergy: Facts and Fancies, 495
- Findlay, J. P., Facial Paralysis, 47
- Fractures
  - and Dislocations, [Geckeler] 430
  - Management of, [Key & Conwell] 168
- Friedman, A. P., Modern Headache Therapy, 497
- Fulton, J. F., Frontal Lobotomy and Affective Behavior: A Neurophysiological Analysis, 745
- Furcolowe, C., This Will Kill You, 563
- Galen's Hygiene, Translation of, [Green] 567
- Gaunt, R., Hormones and Body Water, 498
- Geckeler, E. O., Fractures and Dislocations for Practitioners, 430
- Genetics, Introduction to, [Goldschmidt] 630
- Gindes, B. C., New Concepts of Hypnosis as an Adjunct to Psychotherapy and Medicine, 565
- Goldschmidt, R. B., Understanding Heredity — Introduction to Genetics, 630
- Gordon, E. E., Multiple Sclerosis, 568
- Green, R. M., A Translation of Galen's Hygiene, 567
- Guenzel, L., Medical Ethics and Their Effect Upon the Public, 628
- Gyorgy, P., editor, Vitamin Methods, 115
- Hall, V. E., editor, Annual Review of Physiology, 625
- Halperin, G., Your Blood Pressure and You, 47
- Harris, R. S., Vitamins and Hormones, 373
- Hass, J., Congenital Dislocation of the Hip, 304
- Hayden, Adaline C., Standard Nomenclature of Diseases and Operations, 373
- Headache
  - Therapy, Modern, [Friedman] 497
- Health
  - Education, 374
  - Education, Community in Action, [Patterson & Roberts] 305
  - Instruction Yearbook, 1951, [Byrd] 305
  - Mental, Battle for, [Moloney] 373
  - Public and Disease, [Dublin] 692
- Heart
  - Failure, [Master & others] 627
- Henschel, A., The Biology of Human Starvation, 167
- Heredity
  - Understanding, [Goldschmidt] 630
- Herrmann, G. R., Methods in Medicine, 628
- Hip
  - Congenital Dislocation of, [Hass] 304
- Hormones
  - and Body Water, [Gaunt & Birnie] 498
  - and Vitamins, [Harris & Thimann] 373
  - Research, Progress in, [Pincus] 495

Hoskins, Margaret M., Essentials of Histology, 566
Hospital
  Know Your, [Dorin] 497
  Purchasing File 1952, 562
Impedance, Electrical, [Lofgren] 745
Injury of Xiphoid, [Burman & Sinberg] 743
Instinct
  Study of, [Tinbergen] 630
Jaffe, H. L., Cardiac Emergencies and Heart Failure, 627
Jeffress, L. A., editor, Cerebral Mechanism in Behavior, The Hixon Symposium, 626
Jonez, H. D., My Fight to Conquer Multiple Sclerosis, 742
Jordan, E. P., Prescription for Medical Writing, A Useful Guide to Principles and Practice of Effective Scientific Writing and Illustration, 627
Kaiser, E., The Rheology of the Cross Striated Muscle Fibre, 629
Keith, A., Menders of the Maimed, 561
Kendall, Florence P., Posture and Pain, 500
Kendall, H. O., Posture and Pain, 500
Key, J. A., The Management of Fractures, Dislocations and Sprains, 168
Keys, A., The Biology of Human Starvation, 167
Kinesiology in Nursing, [Bernice Fash] 742
Klein, G., Therapy of Dermatologic Disorders Including a Guide to Diagnosis and a Dermatologic Pharmacopeia, 430
Kleinberg, S., The Henry L. Jaffe Anniversary Number of the Bulletin of the Hospital for Joint Diseases, 567
Kleiner, I. S., Human Biochemistry, 304
Knee and Related Structures, [Lewin] 740
Koller, L. R., Ultraviolet Radiation, 561
Krug, Elsie E., An Introduction to Materia Medica and Pharmacology, 168
Krusen, F. H., editor, Physical Medicine and Rehabilitation for the Clinician, 498
Krusen, F. H., editor, The 1951 Year Book of Physical Medicine and Rehabilitation, 628
Langfeldt, G., The Hypersensitive Mind in Normals, Neurotics, Psychopaths and Psychotics: Prevention and Treatment, 744
Larson, E. A., The Porphyrins and Their Relation to Disease, 243
Lederer, F. L., Diseases of the Ear, Nose and Throat, 743
Lewin, P., The Knee and Related Structures: Injuries, Deformities, Diseases, Disabilities, 741
Licht, S., editor, Physical Medicine in General Practice, 740
Lindner, R. M., New Concepts of Hypnosis as an Adjunct to Psychotherapy and Medicine, 565
Lobotomy, Frontal, and Affective Behavior, [Fulton] 745
Loewenberg, S. A., Medical and Physical Diagnosis, 628
Lofgren, B., The Electrical Impedance of a Complex Tissue and Its Relation to Changes in Volume and Fluid Distribution: A Study on Rat Kidneys, 745
MacBryde, C. M., editor, Signs and Symptoms, 630
Mainland, D., Elementary Medical Statistics, 694
Man
  and His Years, 626
Manipulation, Treatment of, [Burrows & Coltart] 744
Master, A. M., Cardiac Emergencies and Heart Failure, 627
Materia Medica
  Introduction to, [Elsie Krug & McGuigan] 168
Matthes, K., and Rech, W., editors, Der Ultraschall in Der Medicine, 563
McClellan, W. S., Physical Medicine and Rehabilitation for the Aged, 499
McDowell, F., Plastic Surgery of the Nose, 304
McGuigan, H. A., An Introduction to Materia Medica and Pharmacology, 168
Mechanism
  Cerebral, [Jeffress] 626
Medicine
  Administrative, [Emerson] 741
  Industrial [Stone] 629
  Methods in, [Herrmann] 628
  Social, in Western Europe, [Weinerman] 374
Mickelsen, O., The Biology of Human Starvation, 167
Mind
  and Appearance, [Apton] 627
  Hypersensitive in Normals, Neurotics, Psychopaths and Psychotics, [Langfeldt] 744
Moloney, J. C., The Battle for Mental Health, 373
Monro, T. K., The Physician as Man of Letters, Science and Action, 694
Moorman, L. J., Pioneer Doctor, 114
Morality
  Sexual, [Duvall] 742
Morrissey, Alice B., Rehabilitation Nursing, 743
Moser, M., Cardiac Emergencies and Heart Failure, 627
Muscle
  Cross Striated, [Buchthal & Kaiser] 629
Musser, J. H., Internal Medicine: Its Theory and Practice, 562
Neuro-Anatomy
  Functional, [Buchanan] 304
Neurology
  Diseases of Nervous System, [Brain] 693
  Synopsis of, [Tatlow & others] 694
Nomenclature
  of Diseases and Operations, [Plunkett & Adaline Hayden] 373
Nord, F. F., editor, Advances in Enzymology and Related Subjects of Biochemistry, 692
Nose
  Diseases of, [Lederer] 743
  Plastic Surgery of, [Brown & McDowell] 304
Nursing
  Kinesiology, [Bernice Fash] 742
  Rehabilitation, [Alice Morrissey] 743
Operations
  Nomenclature of, [Plunkett & Adaline Hayden] 373
Orthopaedics
  Chiropodial, [Charlesworth] 627
  Orthopedic Surgeons, [Pease] 496
Osol, A., The Dispensatory of the United States of America, 1950, 114
Pain
  and Posture, [Kendall & others] 500
Paralysis
  Facial, [Findlay] 47
Patterson, R. S., Community Health Education in Action, 305
Pease, C. N., editor, The American Academy of Orthopedic Surgeons Instructional Course Lectures, 496
Peck, S. M., Therapy of Dermatologic Disorders, Including a Guide to Diagnosis and a Dermatologic Pharmacopeia, 430
Pharmacology
  Introduction to, [Elsie Krug & McGuigan] 168
  Pharmacopeia, Dermatologic, [Peck & Klein] 430
Physical Medicine
  and Rehabilitation, for the Aged, [McClellan] 499

  and Rehabilitation, for the Clinician, [Krusen] 498
  and Rehabilitation, Yearbook, 1951, [Krusen & others] 628
  in General Practice, [Bierman & Licht] 740
Physicians
  Lives of, in Non-Medical Fields, [Monro] 694
Physiology
  Annual Review, [Hall] 625
  General Textbook,]Davson] 497
Physiotherapists
  Textbook of Medical Conditions for, [Joan Cash] 305
Pilgrimage
  A Doctor's, [Brasset] 373
Pincus, G., editor, Recent Progress in Hormone Research, 495
Plastic Surgery, [Apton] 627
  of Nose, [Brown & McDowell] 304
Plunkett, R. J., Standard Nomenclature of Diseases and Operations, 373
Plutonium
  Project, Industrial Medicine, [Stone] 629
Porphyria
  Relation to Disease, [Watson & Larson] 243
Posture
  and Pain, [Kendall & others] 500
Price, A. H., A Course in Practical Therapeutics, 305
Pullen, R. L., editor, Medical Diagnosis: Applied Physical Diagnosis, 47
Radiation
  Beta, External, [Zirkle] 693
Rehabilitation
  and Physical Medicine for the Aged [McClellan] 499
  and Physical Medicine for the Clinician [Krusen] 498
  in Nursing, [Alice Morrissey] 743
Rehfuss, M. E., A Course in Practical Therapeutics, 305
Rheology
  of Cross Striated Muscle, [Buchthal & Kaiser] 629
Roberts, Beryl J., Community Health Education in Action, 305
Rothmann, S. C., editor, Constructive Uses of Atomic Energy, 499
Rusk, H. A., Physical Rehabilitation for Daily Living, 562
Scalp
  in Health and Disease, [Behrman] 744
Scholtz, H. G., Physikalisch-Diatetische Therapie, 115
Science
  Scientific Paper [Trelease] 500
Sclerosis Multiple, Fight to Conquer, [Jonez] 742
Selye, H., The Story of the Adaptation Syndrome, 740
Selye, H., Textbook of Endocrinology, 742
Shattuck, G. C., Diseases of the Tropics, 114
Shepard, W. C., Prescription for Medical Writing, A Useful Guide to Principles and Practice of Effective Scientific Writing and Illustration, 627
Shock, N. W., Conference on Problems of Aging, 498
Shorr, E., editor, Factors Regulating Blood Pressure 46
Sigerist, H. E., A Translation of Galen's Hygiene, 567
Sinberg, S. E., Injury of the Xiphoid, 743
Skin
  Tumors, [J. Eller & W. Eller] 693
Sleep
  Without Pills, [Tracy] 692
Social Medicine
  in Western Europe, [Weinerman] 374
Speech
  Habilitation in Cerebral Palsy, [Cass] 243
Spiegelman, M., The Facts of Life from Birth to Death, 692
Sprains
  Management of, [Key & Conwell] 168
Starvation
  Human, Biology of, [Keys & others] 167
Statistics
  Medical, [Mainland] 694
Steindler, A., Post-Graduate Lectures on Orthopedic Diagnosis and Indications, 565
Stewart, Margaret R., From Dugout to Hilltop, 625
Stone, R. S., editor, Industrial Medicine on the Plutonium Project; Survey and Collected Papers, 629
Stress
  Biologic, [Selye] 740
Symptoms
  and Signs, [MacBryde] 630
Syndrome
  Adaptation, Story of, [Selye] 740
System
  Nervous, Electrical Activity, [Mary Brazier] 500
Tatlow, W. F. T., A Synopsis of Neurology, 694
Taylor, H. L., The Biology of Human Starvation, 167
Therapeutics
  Practical, A Course in, [Rehfuss & Price] 305
Therapy
  Current, 1952, [Conn] 694
  Physical-Dietetic, [Scholtz] 115
Thimann, K. V., Vitamins and Hormones, 373
Thompson, W. O., editor, The 1950 Year Book of Endocrinology, 167
Throat
  Diseases of, [Lederer] 743
Tinbergen, N., The Study of Instinct, 630
Tracy, D. F., How to Sleep Without Pills, 692
Treatment, Medical, [Evans] 167
Trelease, S. F., The Scientific Paper: How to Prepare It, 500
Tumors
  of Skin, [J. Eller & W. Eller] 693
Ucko, H., Endocrine Diagnosis, 745
Ultrasound
  in Medicine, [Matthes & others] 563
Vitamins
  and Hormones, [Harris & Thimann] 373
  Methods,]Gyorgy] 115
Water
  Body and Hormones, [Gaunt & Birnie] 498
Watson, C. J., The Porphyrins and Their Relation to Disease, 243
Weinerman, E. R., Social Medicine in Western Europe, 374
Woeber, K., editor, Der Ultraschall in Der Medicine, 563
Wohl, M. G., Internal Medicine: Its Theory and Practice, 562
Wood, H. C., Jr., editor, The Dispensatory of the United States of America, 1950, 114
Writing
  Medical, Prescription for, [Jordan & Shepard] 627
Xiphoid
  Injury of, [Burman & Sinberg] 743
Zirkle, R. E., editor, Biological Effects of External Beta Radiation, 693
Zweifach, B. W., editor, Factors Regulating Blood Pressure, 46

C

CARCINOMA: Effect of Ultrasound on, [Schroder] *660

- CEREBRAL DIATHERMY: Some Effects on Normal Adults, [Stoner & Shapiro] *272
- CEREBRAL PALSY: Occupational Therapy for, [James] 48—ab
  - Cerebrovascular Accident, [Steegman] 504—ab
  - Cerebrovascular Accident, Management of, [Feldman] 117—ab
- CERVICAL DISKS: Protrusion of, [Love] 375—ab
- COLD: Control in Industry, [Hill] 696—ab
  - Injury Local, Effect of Rapid and Prolonged Rewarming, [Pichotka & Lewis] 307—ab
- CORTISONE: in Rheumatoid Arthritis, [Price & others] 306—ab
  - Use of in Management of Shoulder-Hand Syndrome, [Sussman] *289
- COULTER MEMORIAL LECTURE: Second, Report on International Congress of Physical Medicine, [Krusen] *651
  - Significance of, 689-E
- CRUTCHES: for Rehabilitation, [Hoberman & Cicenia] 696—ab
  - Tilted Handpiece, [Park & others] *731

D

- DETECTOR: Pulse, Portable, [Fleck] *686
- DEVICE: Measurement of Differences in Height, Opposite Sides of Body, [Seiger] 49—ab
  - Medical, Federal Control of, [Kerlan] *225
  - Standing, for Polio Patients, [Blau & others] *159
  - Traction, for Fractures of Forearm, [Wichern & Bacon] 50—ab
  - Two Important Statistical Devices, [Jung] *711
- DIATHERMY: Generators, [Hall] *28
  - Indications for, 164—E
  - Rules and the Physician, 163—E
- DISTEMPER: Ultraviolet Hemo-Irradiation, Ineffectiveness of, [Wakim & others] *339
- DYSFUNCTION: of Shoulder Girdle, [Doppelt & Goldberg] 169—ab
- DYSHIDROSIS: [Thomson] 50—ab

DEATHS

- Arnold, Clifford H., 166
- Groedel, Franz M., 113
- Harris, Samuel J., 429
- Holman, Henry D., 494
- Kerby, James P., 302
- Lee, Joshua M., 113
- Mendenhall, William E., 113
- Osborne, Stafford L., 688

E

- EDUCATION: Cross, [Frances Hellebrandt] 246—ab
  - Physical Therapy Problems, 689—E
  - Registry Exam, Sex Difference Performance, [Gerken] *345
  - Teaching, Therapeutic, [Hoberman & Cicenia] *539
  - Therapy, Introduction to Problems, [Friedland & Margolin] *21
  - Therapy in Veterans Administration Rehabilitation Program, [Newman & Popell] *477
  - Therapy, Vocational Testing, [King & Dyer] *613
- ELBOW: Fractures of, [Blount & others] 632—ab
- ELECTROKYMOGRAPH: Used as Study for Heart, [Eddleman & others] 170—ab
- ELECTPOMYOGRAPHY: [White & Amos] 307—ab
  - Recording of Muscular Activity in Normal and Spastic Gaits, [Hirschberg & Nathanson] *217
- ELECTROTHERAPY: Simplified, [Mead] *267
- EMPYEMA: Chronic, [Sellors & Cruickshank] 172—ab
- ERGOGRAPHY: Clinical Applications, [Frances Hellebrandt & Sara Jane Houtz] 635—ab
  - Elbow Flexion, Precision Under Muscular Fatigue, [Clarke] *279
- ETHYL CHLORIDE: Spray for Painful Muscle Spasm, [Janet Travell] *291
- EXERCISE: and Regulation of Body Temperature, [Bazett] 502—ab
  - for Shoulder Dislocation After Bankart Operation, [Rudd & Haydock] *353
  - Heavy Resistance, [Zinovieff] 116—ab
  - Resistive, in Treatment of Poliomyelitis, [Schram] *549

F

- FEMUR: Fractures, Apparatus for Treatment, [Spittler & Brennan] 169—ab
- FIBROSITIS: Nature and Treatment, [Martin] *409
  - Pathogenetic Concepts, [Neufeld] *363
- FRACTURES: of Elbow, [Blount & others] 632—ab
  - of Femur, [Spittler & Brennan] 169—ab
  - of Forearm, Traction Device, [Wichern & Bacon] 50—ab
  - of Humerus, [Powers] 245—ab
  - of Metatarsals and Tarsals, [Bennett] 169—ab
  - Vascular Complications, [Miller & Markin] 50—ab
- FROSTBITE: [Agnes Spock-Ward] 748—ab

G

- GERIATRICS: Rehabilitation in Institutional, [Dobrin] 570—ab

H

- HAND: Injuries, Immediate Treatment, [Koch] 307—ab
  - Surgery, Reconstructive, [White] 51—ab
- HEART: Studies by Electrokymograph [Eddleman & others] 170—ab
- HEMIPLEGIA: Relaxation of Muscle, [LaJoie & Gersten] *595
  - Rehabilitation of Patient, [Rinzler & others] 748—ab
- HEMOGRAM: of Febrile White Rats, Influence of Pituitary-Adrenal Axis, [Hubler & others] *391
- HEMOIRRADIATION: Ultraviolet, Ineffectiveness in Distemper, [Wakim & others] *339
- HERNIA: Rehabilitation Following, [Aldes & Frances Koerner] *721
- HIP: Rotator, [Beauchamp] 632—ab
- HUMERUS: Fractures of, [Powers] 245—ab

I

- IDIOPATHY: Scoliosis, Pain Incidence, [Bender & others] *406
- INCONTINENCE: Stress, Treatment of, [Huffman & others] *674
- INDUSTRY: Medicine and Ultrasound, [Parrack] 746—ab
- INHERITANCE: of Muscular Dystrophy, [Tyler & Stephens] 172—ab
- INJURIES: Athletic and Physical Medicine, 239—E
  - Bone and Nerve, [Tobin] 501—ab
  - Cold, Local, Effect of Rapid and Prolonged Rewarming, [Pichotka & Lewis] 307—ab
  - Hand, Immediate Treatment, [Koch] 307—ab
  - Industrial, Physical Medicine and Rehabilitation, [Martin] 244—ab
  - Peripheral Nerve, Recognition of, [Mastellone] 503—ab
  - Spinal Cord, [Pollock & others] 632—ab

  Thoracic in World War II, [O'Connor] 308—ab
  to Roots and Branches of Lumbar Plexus, Diagnosis, [Psaki & Kuitert] *10
INSTITUTIONS: Ethical Relationships Between Physiatrists and, 37—E
IRITIS: Symptom in Ankylosing Spondylitis, [Birkbeck & others] 631—ab
ISCHEMIA: Necrosis of Anterior Tibial Muscle, [Psaki & Schields] *153
ISOTOPES: Radioactive and Malignancy, [Chamberlain] 52—ab

L

LEG: Splint, [Clarke] 504—ab
LOW BACK: Disorders, Muscle Relaxants in, 49—ab
LUMBAR PLEXUS: Injury, Diagnosis of, [Psaki & Kuitert] *10
LYMPH: Flow, Effect of Massage on, [Margaret Ladd & others] *604

M

MALIGNANCY: and Radioactive Isotopes, [Chamberlain] 52—ab
MASSAGE: Effect on Flow of Lymph, [Margaret Ladd & others] *604
  Effect on Muscle Temperature and Radiosodium Clearance, [Ebel & Wisham] *399
MEPHENESIN: Intravenous, Use in Physical Medicine, [Mead and others] 501—ab
MULTIPLE SCLEROSIS: Visual and Motor Changes in Patients, [Guthrie] 52—ab
MUSCLE: Activity in Normal and Spastic Gaits, [Hirschberg & Nathanson] *217
  Contraction Time, Effect of Progressive Resistance Exercise on, [De Lorme & others] *86
  Disorders, Studies of [Tyler & Stephens] 172—ab
  Electrodiagnostic Study, [Dobin & Fizzell] 502—ab
  Electromyographic Study, [Dobin & Fizzell] 502—ab
  Necrosis of, [Psaki & Schields] *153
  Paravertebral and Myositis Ossificans, [Creech & Gunter] 634—ab
  Rectus, Spasm of, [Jaffe] 172—ab
  Relaxants in Low-Back Disorders, 49—ab
  Relaxation, [La Joie & Gersten] *595
  Sounds, Influence on Ergographic Work Capacity, [Anna Hoye] 505—ab
  Spasm, Painful, Ethyl Chloride Spray for, [Janet Travell] *291
  Stimulation of for Relaxation of Spasticity, [Levine & others] *668
  Temperature, Effect of Massage on, [Ebel & Wisham] *399
  Transplantation of, [Zachary] 697—ab
MYOSITIS OSSIFICANS: [Creech & Gunter] 634—ab
  and Polio, [Hess] 633—ab

N

NECK: Pain, [Love] 375—ab
NECROSIS: Ischemic, of Anterior Tibial Muscle, [Psaki & Schields] *153
NERVE: Injuries, [Tobin] 501—ab
  Injuries, Peripheral, [Mastellone] 503—ab
  Neuromuscular Dysfunction, Studies, [Kabat] *521
  Palsy, Ulnar, [Saez & Stein] 501—ab
  Peripheral Lesions, [Nash] 748—ab
NEUROPSYCHIATRY: Aspects in Rehabilitation, [Ebaugh] *348
NYLON: Arthroplasty in Rheumatoid and Osteo-Arthritis, [Kuhns & Potter] 308—ab

O

OBLITERANS: Thromboangiitis, [Farber & McLain] 503—ab
OBSTRUCTION: Venous, [Querna] 171—ab
OCCUPATIONAL THERAPY: for Cerebral Palsy, [James] 48—ab
  in Physical Medicine, [Lyttleton] 376—ab
  Prescribed, [Nila K. Covalt] *333

P

PAIN: in Shoulder, [Withers] 695—ab
  Incidence in Idiopathic Scoliosis, [Bender & others] *406
  Musculoskeletal, Relief by Sphenopalatine Block, [Rawlings & Wise] *5
  Relief of, [Shields] 697—ab
PALSY: Nerve, Bilateral Ulnar, [Saez & Stein] 501—ab
PARALYSIS: Restoration of Motor Function, [Kabat] *521
PARKINSONISM: [Garland] 695—ab
  and Rheumatoid Arthritis, [Wallerstein] 51—ab
  Parkinson's Disease, Assessment of Therapy, [Schwab & Prichard] 52—ab
  Parkinson's Syndrome, Treatment, [Yaskin] 634—ab
PERSONNEL: Ancillary, in Field of Physical Medicine and Rehabilitation, 425—E
PHYSIATRIST: Ethical Relationships with Institutions, 37—E
  Training of, [Bennett] *585
PHYSICAL MEDICINE: See also Physical Therapy and Rehabilitation,
  and Athletic Injuries, 239—E
  and Rehabilitation, Ancillary Personnel, 425—E
  and Rehabilitation for the Handicapped Worker Over Forty, [Krusen] *93
  and Rehabilitation for Patients with Hemiplegia, [Burnham] 246—ab
  and Rehabilitation, Importance of for Industrially Injured, [Martin] 244—ab
  and Rehabilitation, Role in Neuropsychiatric Hospital, [Dancik] 747—ab
  and Rehabilitation, Social and Psychologic Aspects, 735—E
  Annals of, 241—E
  Clinical Research in, 491—E
  In General Practice, [Schwartz] 245—ab
  Is It Overworked? 299—E
  Place of Occupational Therapy, [Lyttleton] 376—ab
  Treatment of Peripheral Vascular Disease, [Troedsson] 375—ab
  Use of Intravenous Mephenesin in, [Mead & others] 501—ab
PHYSICAL THERAPY: and Rehabilitation, Daily Activity Testing, [Hoberman & others] *99
  Educational Problems, 689—E
  Effects on Blood Flow, [Barbara Randall & others] *73
  for Hemiplegia, [Rinzler & others] 748—ab
  for Relief of Pain, [Shields] 697—ab
PITUITARY: Adrenal Axis, Influence on Hemogram of White Rats, [Hubler & others] *391
POLIOMYELITIS: [West & Mathieu] 171—ab
  After-care for Patient, [Hoberman] 696—ab
  and Myositis Ossificans, [Hess] 633—ab
  Anterior, [Schlesinger] 631—ab
  Bulbar, Hypoventilation Syndrome, [Sarnoff & others] 118—ab
  Bulbar, Potassium Deficiency in, [Lans & others] 50—ab
  Clinical, Precipitation by Injections, [Goerke] 54—ab

  - Early Diagnosis and Treatment, [Seifert] 49—ab
  - Epidemic, [Lenarsky & others] 171—ab
  - Exercise in Treatment, [Schram] *549
  - Fight Against, [O'Connor] *589
  - in Adults, [Bakke & Haviland] 633—ab
  - Influence of Procaine, [Horvath & others] 696—ab
  - Patients, Convalescent Care of, [Lowman] 48—ab
  - Prognosis of, [Albrecht & Frances B. Locke] 431—ab
  - Rocking Bed, Used for, [Dail & others] 170—ab
  - Second Attacks, [Hoyne & Lipton] 50—ab
  - Standing Device for, [Blau & others] *159
  - Use of Rocking Bed to Augment Ventilation, [Dail & others] 170—ab
  - Weak Thumb Opposition Due to, [Worden & Knapp] *230
- POOL: Therapeutic, [Sverdlik] *486
  - Therapy, Recent Developments, [Milles] 376—ab
- PROCAINE: Block, Treatment by for Shoulder-Hand Syndrome, [Swan & McGowan] 48—ab
  - Influence on Temperature of Polio Patients, [Horvath & others] 696—ab
- PULSE: Detector, Electronic, [Fleck] *686

Q

- QUADRICEPS: Mechanical, [Rudin & Cronin] *15

R

- RADIOISOTOPES: Clinical Use, Safety Factors in, [Powell] 54—ab
  - in Medicine, [Diamond] 169—ab
- REHABILITATION: and Physical Medicine, for Handicapped Worker Over Forty, [Krusen] *93
  - and Physical Medicine for Hemiplegic Patients, [Burnham] 246—ab
  - and Physical Medicine, Importance for Industrially Injured, [Martin] 244—ab
  - and Physical Medicine in Neuropsychiatric Hospital, [Dancik] 747—ab
  - and Physical Medicine, Social and Psychologic Aspects, 735—E
  - Following Ruptured Intervertebral Disc Surgery, [Aldes & Frances Koerner] *721
  - In-Patient Organization, [Nichols] 502—ab
  - Medical, Spa Treatment, [Lockwood] 698—ab
  - Neuropsychiatric Aspects, [Ebaugh] *348
  - of Amputee, [Thomas] *357
  - of Hemiplegic Patient, [Rinzler & others] 748—ab
  - of Patients in General Hospitals, Present and Future Plans, [Nila K. Covalt] 431—ab
  - Role of Vocational, Adjustment in, [Fowlks & others] *137
  - Techniques, Braces and Crutches, [Hoberman & Cicenia] 696—ab
  - Training Program for, 109—E
  - Unit [Kendell] 698—ab
  - Use of Painting in, with Tuberculosis Patients, [Dawson] *147
- REPETIMETER: [Schlesinger] *468
- RESISTANCE EXERCISE: Progressive, Effect on Muscle Contraction Time, [De Lorme & others] *86
- RESOLUTION: 476
- RESPIRATION: Artificial, Manual, [Gordon & others] 635—ab
- RESUSCITATION: Methods Manual, [Gordon & others] 746—ab
- RHEUMATISM: Rheumatic Diseases, Diagnosis and Treatment, Errors and Pitfalls, [Lipkin] 306—ab
  - Rheumatic Diseases, Teamwork in, [Fisher] 118—ab
  - Rheumatoid Arthritis, Cortisone in, [Price & others] 306—ab
- ROENTGEN: Therapy, [Witt & Titterington] 631—ab

S

- SCAPULECTOMY: Partial, [Doppelt & Goldberg] 169—ab
- SCHIZOPHRENIA: Indirect Vasodilatation in Patients, [Henschel & others] 505—ab
- SCIATICA: Treatment of, Tables for Vertebral Elongation, [Neuwirth & others] *455
- SCLEROSIS: Multiple, [Gordon & Carlson] 505—ab
  - Multiple, Art of Medicine in Management, [Gallineck] 245—ab
- SCOLIOSIS: Idiopathic, Incidence of Pain, [Bender & others] *406
- SENESCENCE: Chronic Arthritis of, [Cecil] 118—ab
- SEX: Differences in Performance of Registry Exams, [Gerken] *345
- SHOULDER: Bicipital Syndrome of, [Newman] *534
  - Brace, [Wallace] *553
  - Bursitis [Witt & Titterington] 631—ab
  - Dislocation of, Exercises for, [Rudd & Haydock] *353
  - Dysfunction of, [Doppelt & Goldberg] 169—ab
  - Girdle, Neurovascular Syndromes, [Morest] 695—ab
  - Hand Syndrome, Treatment by Procaine Block of Stellate Ganglion, [Swan & McGowan] 48—ab
  - Hand Syndrome, Use of Cortisone in Management of, [Sussman] *289
  - Painful, [Withers] 695—ab
- SPAS: Treatment and Medical Rehabilitation, [Lockwood] 698—ab
- SPASTICITY: Electromyographic Recording of Muscular Activity, [Hirschberg & Nathanson] *217
  - Relaxation of [Levine & others] *668
  - Spastic Flatfoot, Peroneal, [Webster & Roberts] 48—ab
- SPHENOPALATINE: Block, Relief of Musculoskeletal Pain, [Rawlings & Wise] *5
- SPINE: and Trunk Function, [Quiring] *414
  - Arthritis of, [Blodgett] 170—ab
  - Spinal Cord Injuries, [Pollock & others] 632—ab
  - Spinal Cord Injury, Neurosurgical Aspects, [Smolik] 746—ab
- SPLINT: Sectional for Leg, [Clarke] 504—ab
- SPONDYLITIS: Ankylosing, [Birkbeck & others] 631—ab
  - Ankylosing, Surgical Aspects, [Law] 116—ab
  - Rheumatoid, [Conner] 53—ab
- STATISTICS: Device for, [Jung] *711
- STIMULATION: Electrical, for Spasticity Relaxation, [Levine & others] *668
  - Electrical, for Treatment of Intractable Stress Incontinence, [Huffman & others] *674
- SWEAT: Rate, Changes After Ultraviolet Radiation, [Thomson] 51—ab
- SYNDROMES: Neurovascular of Shoulder Girdle, [Morest] 695—ab

T

- TANK: Therapeutic, and Pool, [Sverdlik] *486
- TARSUS: Tarsal Anomalies and Peroneal Spastic Flatfoot, [Webster & Roberts] 48—ab
- TEMPERATURE: Body, [Wyndham & Wilson-Dickson] 504—ab
  - Body, Regulation of, [Bazett] 502—ab

  Effects of Baths, [Danielson & Kinard] 634—ab
TEST: Daily Activity in Physical Medicine and Rehabilitation, [Hoberman & others] *99
THERAPY: Assessment in Parkinson's Disease, [Schwab & Prichard] 52—ab
  Educational, [King & Dyer] *613
  in Teaching, [Hoberman & Cicenia] *539
  Roentgen, [Witt & Titterington] 631—ab
THORAX: Thoracic Injuries in World War II, [O'Connor] 308—ab
  Thoracoplasty, [Doppelt & Goldberg] 169—ab
THROMBOANGIITIS: Obliterans, [Farber & McLain] 503—ab
THROMBOPHLEBITIS: [Rush & Forsee] 118—ab
TOLSEROL: see Mephenesin
TONSILLECTOMY: Indications for, [Frances Lederer] 170—ab
TRACHEOTOMY: Patients, Use of Aerosol for, [Denton & Schaeffer] *727
TRAINING: Technical, Standardization of, [Arestad] *82
TRAUMATOLOGY: Vascular Complications, [Miller & Markin] 50—ab
TRUNK: and Spine Function, Background for Understanding, [Quiring] *414
TUBERCULOSIS: Patients, Use of Painting in Rehabilitation, [Dawson] *147
  Pulmonary, Energy Costs of Various Physical Activities in Relation to, [Gordon] *201

U

ULTRASONICS: Effect on Carcinoma, [Schroder & others] *660
  Energy, in Blood, Mechanism of Absorption, [Piersol & others] *327
  Energy, Therapeutic Application of, [Friedland & others] *461
  Therapy, Technique, [Bauer] 48—ab
  Ultrasound, and Industrial Medicine, [Parrack] 746—ab
ULTRAVIOLET: Hemo-Irradiation, Ineffectiveness in Distemper, [Wakim & others] *339
  Radiation, Changes in Sweating Rate, [Thomson] 51—ab
  Radiation, Produces Dyshidrosis, [Thomson] 50—ab

V

VASCULAR DISEASE: Peripheral, Arteriosclerotic, Treatment of by Physical Medicine, [Troedsson] 375—ab
VASODILATATION: Indirect in Normal Man, [Henschel & others] 505—ab
VOCATION: Testing in Educational Therapy, [King & Dyer] *613

W

WHEELCHAIR: for Above-Knee Amputees, [Akwa & others] *156
WORK: Ergographic, [Anna Hoye] 505—ab

AUTHOR INDEX

In this Index are the names of the authors which have appeared in the *Archives.* The asterisk (*) preceding the page reference indicates that the article appeared in full in the *Archives,* "d" refers to discussion, "E" refers to editorial and "ab" indicates abstract. For subject index, see page 750.

A

Affeldt, J. E., 118—ab
Akwa, C. M., *156
Albrecht, R. M., 431—ab
Aldes, J. H., *721
Amos, J. D., 307—ab
Arestad, F. H., *82
Arieff, A. J., 632—ab
Austin, Elizabeth, 170—ab

B

Bacon, R. H., 50—ab
Bagby, B. B., Jr., 209—d
Bagnall, A. W., 53—ab
Bakke, J. L., 633—ab
Barker, N. W., 54—ab
Bauer, A. W., 48—ab
Bazett, H. C., 502—ab
Beauchamp, G., 632—ab
Becker, R. J., 50—ab
Behrend, H. J., 298—d
Bender, L. F., *406
Bennett, R. J., 169—ab
Bennett, R. L., *585
Birkbeck, M. Q., 631—ab
Benton, J. G., 748—ab
Biro, L. P., 475—d
Bisgrove, J. G., *461
Blanchard, R. S., *604
Blau, L., *159
Blodgett, W. H., 170—ab
Blount, W. P., 632—ab
Boshes, B., 632—ab
Bower, A. G., 170—ab
Boyle, R. W., 685—d
Boynton, B. L., 288—d, 353—d
Brennan, J. J., 169—ab
Brewer, J. H., 504—ab
Brown, H., 748—ab
Brown, M., 632—ab
Brozek, J., 505—ab
Buckler, W. St. J., 631—ab
Burnham, L. R., 246—ab

C

Campbell, R., *455
Carlson, K. E., 505—ab
Carnesale, P. L., 634—ab
Carstensen, E. L., *327
Carter, H. A., 229—d
Cassidy, R. H., 632—ab
Cecil, R. L., 118—ab
Chamberlain, R. H., 52—ab
Chor, H., 632—ab
Cicenia, E. F., *99, *539, 696—ab
Clarke, B. G., 504—ab
Clarke, H. H., *279
Colonna, P. C., 52—ab
Conner, S. K., 53—ab
Cooper, A. L., *137
Covalt, Nila K., *333, 338—d, 431—ab
Creech, B., 634—ab
Cronin, D. J., *15
Cruickshank, G., 172—ab
Currence, J. D., 488—d
Curtis, R. M., 504—ab

D

Dail, C. W., 170—ab
Dancik, D., 747—ab
Danielson, R. N., 634—ab
Darley, W., 224—d
Dawson, A. R., *147, 152—d
Deaver, G. G., 352—d
De Lorme, T. L., *86
Denton, R., *727
Diamond, H. D., 169—ab
Dobin, N. B., 502—ab
Dobrin, L., 570—ab
Doppelt, H. B., 169—ab
Doyle, B. J., *461
Dyer, G. W., *613

E

Ebaugh, F. G., *348
Ebel, A., *399
Eddleman, E. E., Jr., 170—ab
Elkins, E. C., *406

F

Farber, E. M., 503—ab
Feldman, L., 117—ab
Ferris, B. G., *86
Finkelman, I., 632—ab
Finkle, J. R., 632—ab
Fisher, A. G. T., 118—ab
Fizzell, J. A., 502—ab
Fleck, H., *686
Forsee, J. H., 118—ab
Fowlks, E. W., *137
Fricke, F. J., *210, 216—d, 488—d

Friedland, F., *20, *461

G

Gallagher, J. R., *86
Gallinek, A., 245—ab
Gamble, S. G., 726—d
Garland, H. G., 695—ab
Garry, M. W., 634—ab
Gerken, C. d'A., *345
Gersten, J. W., *210, *595
Gillette, Harriet, 533—d
Goerke, I. S., 54—ab
Goldberg, J., 169—ab
Goldman, L., 51—ab
Gordon, A. S., 635—ab, 746—ab
Gordon, E. E., *201, 505—ab
Grynbaum, B. B., 603—d
Gunter, J. U., 634—ab
Guthrie, T. C., 52—ab

H

Hale, C., 635—ab
Hall, E. L., *28, 163—E
Harell, A., 501—ab
Haviland, J. W., 633—ab
Haydock, Eileen F., *353
Heilman, F. R., *339
Hellebrandt, F. A., 246—ab, 635—ab
Henschel, A., 505—ab
Herrick, Julia F., *391, *660
Hess, W. E., 633—ab
Heyer, H. E., 170—ab, 570—ab
Higgins, G. M., *391
Hilde, Winifred, *455
Hill, A. K., 696—ab
Hines, H. M., *73, 81—d
Hirschberg, G. G., *217, 224—d, 225—d
Hoberman, M., *99, *539, 696—ab
Horvath, S. M., 696—ab
Houtz, Sara Jane, 635—ab
Hoye, Anna Scott, 505—ab
Hoyne, A. L., 50—ab
Hubler, W. L., *391
Huddleston, O. L., 170—ab
Huffman, J. W., *674

I

Imig, C. J., *73
Ivy, A. C., 635—ab, 746—ab

J

Jaffe, N. B., 172—ab
James, E. M., 48—ab
Janes, J. M., *406
Jenkins, J. G., 215—d
Jung, F. T., 398—d, *711

K

Kabat, H., *521, *668
Karlson, A. G., *660
Kendell, H. W., 698—ab
Kerlan, I., *225, 229—d
Kessler, H., 548—d
Keys, A., 505—ab
Kinard, F. W., 634—ab
King, L. H., *613
Knapp, M. E., *230, 234—d
Knott, Margaret, *668
Koch, S. L., 307—ab
Koerner, Frances, *721
Kottke, F. J., *604, 612—d
Krusen, E. M., Jr., 224—d
Krusen, F. H., *93, *339, *651
Krynicki, F. X., 746—ab
Kuhns, J. G., 308—ab
Kuitert, J. H., *10, 538—d

L

Ladd, Margaret P., *604, 612—d
La Joie, W. J., *595, 603—d
Lans, H. S., 50—ab
Law, W. A., 116—ab
Lederer, Frances L., 170—ab
Lenarsky, M., 171—ab
Levin, I., 271—d
Levine, M. G., *668
Lewis, R. B., 307—ab, 570—ab
Lightbody, J. J., 306—ab
Lipkin, E., 306—ab
Lipton, I., 50—ab
Locke, Frances B., 431—ab
Lockwood, R. A., 698—ab
Love, J. G., 375—ab
Lowman, C. L., 48—ab
Lustig, F., 344—d
Lyttleton, Phyllis, 376—ab

M

Mahoney, Florence I., 151—d
Malone, Eleanore W., *731
Margolin, R. J., *20
Markin, L., 50—ab
Martin, A. J., *409
Martin, G. M., 244—ab
Martucci, A. A., 278—d
Mason, R. M., 631—ab
Massie, F. M., 503—ab
Mastellone, A. F., 503—ab
Mathieu, P. L., Jr., 171—ab
McGowan, J. M., 48—ab
McLain, M. H., 503—ab
McMorris, R. O., *406
Mead, N. C., 49—ab
Mead, S., *267, 272—d, 476—d, 501—ab
Meier, F., 635—ab
Meislin, J., 488—d
Mercer, W., 571—ab
Merliss, H., 633—ab
Meyer, K. A., 50—ab
Miller, D. S., 50—ab
Milles, H. G., 376—ab
Molander, C. O., 485—d
Moor, F. B., 413—d
Morest, F. S., 695—ab
Mueller, Emily E., 501—ab

N

Nash, F. P., 748—ab
Nathanson, M., *217
Neu, H. N., 306—ab
Neufeld, I., *363
Neuwirth, E., *455
Newman, L. B., *477, 612—d
Newman, R. W., *534
Nichols, P. J. R., 502—ab

O

O'Connor, B., *589
O'Connor, J. P., 308—ab
Olney, R. C., 343—d
Osborne, S. L., *674

P

Park, H. W., 81—d, *731
Parr, R. L., 171—ab
Parrack, H. O., 746—ab
Paul, W. D., 298—d, 696—ab
Pennell, R. B., *327
Phillips, J., *159
Piaskoski, R., *156, 460—d
Pichotka, J., 307—ab
Piersol, G. M., *327, 569—ab
Pollock, L. J., 632—ab
Popell, I. R., *477
Potter, T. A., 308—ab
Powell, C. C., 54—ab
Powers, J. A., 245—ab
Price, A. E., 306—ab
Prichard, J. S., 52—ab
Psaki, R. C., *10, *153

Q

Querna, M. H., 171—ab
Quiring, D. P., *414

R

Randall, Barbara F., *73
Rausten, D. S., 344—d
Rawlings, M. S., *5
Raymon, F., 746—ab
Reedy, W. J., 306—ab
Reveno, W. S., 306—ab
Rinzler, S. H., 748—ab
Roberts, W. M., 48—ab
Root, L. M., *156
Rose, D. L., *159
Rose, I. W., Jr., 504—ab
Roth, Gloria, 338—d
Rudd, J. L., *353, 356—d
Rudin, L. N., *15
Rudolph, H. L., 234—d, 338—d
Rush, J. T., 118—ab

S

Sadove, M. S., 746—ab
Saez, J., 501—ab
Samberg, H., 216—d, 224—d
Sarnoff, S. J., 118—ab
Schaeffer, J. N., *727
Schields, C. D., *153
Schlesinger, E. B., 631—ab
Schlesinger, R. A., *468
Schlotthauer, C. F., *339
Schram, D. A., *549
Schroder, J. D., *660
Schultz, I., 632—ab
Schwab, R. S., 52—ab
Schwan, H. P., *327
Schwartz, F. F., 245—ab
Seanor, H. E., 171—ab
Seifert, M. H., 49—ab
Seiger, H. W., 49—ab
Selle, W. A., 467—d
Sellors, T. H., 172—ab
Shapiro, H., *272
Shields, C., 697—ab
Shumaker, L. K., *137
Smith, E. M., 697—ab, 720—d
Smith, R. T., 146—d
Smolik, E. A., 746—ab
Snow, W. B., 225—d, 356—d
Sokol, J. K., *674
Spittler, A. W., 169—ab
Spock-Ward, Agnes, 748—ab
Star, Shirley, 635—ab

Steegmann, A. T., 504—ab
Steglich, Ruth, *731
Stein, I. D., 501—ab
Stein, I. F., Jr., 50—ab
Steindler, A., 747—ab
Stephens, F. S., 172—ab
Stephenson, G. R., *99
Stoner, E. K., *272
Sussman, N., *289
Sverdlik, S., *486, 488—d
Swan, D. M., 48—ab

T

Taylor, H. N., 696—ab
Tegner, W. S., 631—ab
Thomas, A., *357
Thomson, M. L., 50—ab, 51—ab
Titterington, P. F., 631—ab
Tobin, W. J., 501—ab
Todd, E., Jr., 503—ab
Travell, Janet, *291, 298—d
Troedsson, B. S., 375—ab
Tyler, F. H., 172—ab

V

Valentine, L. F., 344—d
Vonder Heide, E. C., 306—ab
von Werssowetz, O. F., 361—d, 569—ab, *676

W

Wakim, K. G., *339, 344—d
Wallace, R. B., *553
Wallerstein, R. O., 51—ab
Watkins, A. L., 570—ab
Webster, F. S., 48—ab
Weiss, J., 405—d
Welsh, E. C., *156
Werner, A. Y., 696—ab
West, E. J., 171—ab
White, A. E., 307—ab
White, W. L., 51—ab
Whittenberger, J. L., 118—ab
Wichern, W. A., 50—ab
Willis, Kathryn, 170—ab
Wilson-Dickson, W. G., 504—ab
Wise, C. S., *5
Wisham, L. H., *399
Withers, R. J. W., 695—ab
Witt, C. M., 631—ab
Worden, R. E., *230
Wyndham, C. H., 504—ab

Y

Yaskin, J. C., 634—ab

Z

Zachary, R. B., 697—ab
Zinovieff, A. N., 116—ab

INDEX TO PAGES

Of the Archives, According to Monthly Issues—Volume XXXIII, January-December, 1952

1— 64	1	January
65—128	2	February
129—192	3	March
193—256	4	April
257—320	5	May
321—384	6	June
385—448	7	July
449—512	8	August
513—576	9	September
577—640	10	October
641—704	11	November
705—768	12	December

CHICAGO SOCIETY OF PHYSICAL MEDICINE AND REHABILITATION

Wednesday, January 28, 1953

Dinner, 6:15 P. M., A. M. A. headquarters, 5th floor dining room,
535 N. Dearborn St., Chicago 10, Ill.

Business meeting, immediately following dinner.

Scientific Session, 8:00 P. M., A. M. A. headquarters, 9th floor auditorium.

Subjects:

"The Council on Physical Medicine and Rehabilitation of the American Medical Association."
Dr. Ralph E. De Forest, Secretary of Council.
"Demonstration of Some Physical Principles Used in Medical Apparatus."
Howard A. Carter, M.E., Director, Bio-Physical Investigation,
Council on Physical Medicine and Rehabilitation
"The Physical Laboratory of the Council on Physical Medicine and Rehabilitation."
Frederic T. Jung, M.D., Director, Physical Laboratory.

Make your reservations early with Dr. I. F. Hummon, Secretary-Treasurer,
30 N. Michigan Ave., Chicago 2.

PHYSICAL MEDICINE AND REHABILITATION **

The following services are approved by the Council on Medical Education and Hospitals, and the American Board of Physical Medicine and Rehabilitation. Residencies in this specialty have been approved without specifying the number of years for which they are accredited. The Board will give appropriate credit for training in these hospitals on an individual basis.

Hospitals, 45; Assistant Residencies and Residencies, 85.

Name of Hospital	Location	Chief of Service	Inpatients Treated	Number of Treatments	First Year Residencies Offered[3]	Total Residencies Offered[3]	Beginning Stipend (Month)
UNITED STATES ARMY							
Letterman Army Hospital★	San Francisco	R. C. Psaki	4,231	116,264	....	....	......
Fitzsimons Army Hospital★	Denver	H. B. Luscombe	7,045	230,440	....	....	......
Army Medical Center★	Washington, D. C.	J. H. Kuitert	5,224	344,228	1	4	......
VETERANS ADMINISTRATION							
Veterans Admin. Hospital★[1-2]	Long Beach, Calif.	Roy H. Nyquist	3,305	182,286	1	1	......
Veterans Admin. Hospital[1-2]	Denver	C. C. Hoffman	731	11,804	1	1	......
Veterans Admin. Hospital[1]	Hines, Ill.	L. B. Newman	5,135	463,131	4	4	......
Veterans Admin. Hospital[1-2]	Wadsworth, Kan.	L. Blau	2,471	174,247	1	2	......
Veterans Admin. Hospital[1-2]	Framingham, Mass.	F. Friedland	7,100	214,000	1	3	......
Veterans Admin. Hospital[1-2]	New York City	A. S. Abramson	4,196	302,119	1	3	......
Veterans Admin. Hospital[1-2]	Cleveland	H. T. Zankel	1,646	78,194	1	1	......
Veterans Admin. Hospital[1-2]	Portland, Ore.	E. W. Fowlks	4,369	112,456	1	2	......
Veterans Admin. Hospital[1]	Aspinwall, Pa.	S. Machover	1,957	56,412	1	1	......
Veterans Admin. Hospital[2]	Memphis, Tenn.	F. I. Mahoney	10,090	152,031	....	....	......
Veterans Admin. Hospital★[1-2]	Houston, Texas	B. L. Boynton	1,682	60,589	1	2	......
Veterans Admin. Hospital★[1-2]	Milwaukee	R. Piaskoski	16,084	209,092	....	....	......
NONFEDERAL							
Los Angeles County Hospital★[1-2]	Los Angeles	E. Austin	....	93,906	....	1	173
White Memorial Hospital★[1-2]	Los Angeles	F. B. Moor	39,608	39,608	1	1	132
University of Colorado Medical Center Colorado General Hospital★[1-2]	Denver	H. Dinken	2,177	38,381	1	2	150
State of Connecticut Veterans Home and Hospital[1-2]	Rocky Hill, Conn.	N. K. Covalt	663	63,375	....	3	253.34
George Washington University Hospital[1-2]	Washington, D. C.	C. S. Wise	2,433	15,563	....	....	130
Emory University Hospital★[1-2]	Emory Univ., Ga.	R. L. Bennett	1,001	15,846	....	1	250
Georgia Warm Springs Foundation[1-2]	Warm Springs, Ga.	R. L. Bennett	998	114,110	1	4	250
Michael Reese Hospital★[1-2]	Chicago	C. Molander	3,589	30,929	1	1	25
Northwestern University Medical Center[1-2]	Chicago		13,752	43,409	....	....	50
Research and Educational Hospitals★[1-2]	Chicago	F. A. Hellebrandt	12,266	12,266	1	3	60
University of Kansas Medical Center★[1-2]	Kansas City, Kan.	D. Rose	2,563	49,649	....	1	125
Massachusetts General Hospital★[1-2]	Boston	A. L. Watkins	3,039	33,483	....	2	66.67
University Hospital★[1]	Ann Arbor, Mich.	J. W. Rae, Jr.	....	20,659	2	6	134.16
University of Minnesota Hospitals★[1-2]	Minneapolis	F. J. Kottke	14,007	25,194	2	6	142.50
Mayo Foundation[1-2]	Rochester, Minn.	F. H. Krusen	....	....	2	6	150
Barnes Hospital★[2]	St. Louis	S. Mead	9,572	9,572	....	1	25
Bellevue Hospital Center—Division III—New York University College of Medicine★[1-2]	New York City	H. A. Rusk	1,082	83,147	4	7	80
Goldwater Memorial Hospital★[1-2]	New York City	M. Dacso	674	44,446	1	2	90
Hospital for Joint Diseases★[1-2]	New York City	J. Weiss	....	90,407	1	2	60
Hospital for Special Surgery[2]	New York City	K. G. Hansson	19,388	37,284	1	1	160
Metropolitan Hospital[1-2]	New York City	J. Tobis	1,023	24,788	....	....	......
Mount Sinai Hospital★[1-2]	New York City	W. Bierman	8,464	32,947	1	1	50
New York City Hospital★[1-2]	New York City	F. K. Safford, Jr.	1,030	37,080	1	1	160
Presbyterian Hospital★[1-2]	New York City	R. C. Darling	5,011	175,061	1	1	208.33
St. Luke's Hospital★[1-2]	New York City	R. Muller	1,099	115,572	1	1	60
Rehabilitation Hospital[1-2]	West Haverstraw, N. Y.	M. Hoberman	517	332,205	1	1	225
Cleveland Clinic Hospital[1-2]	Cleveland	W. J. Zeiter	16,638	36,957	1	3	150
University Hospitals Ohio State University Hospital[1-2]	Columbus, Ohio	R. E. Worden	1,245	15,894	....	....	125
Hospital of the Univ. of Pennsylvania★[1-2]	Philadelphia	G. Piersol	2,771	45,549	....	1	......
Philadelphia General Hospital★[1-2]	Philadelphia	A. Martucci	1,225	66,802	2	2	112

The Star (★) indicates hospital approved for intern training.
1 Residencies open to women.
2 Available to graduates of foreign medical schools.
3 Includes fellowships.
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